NUCLEAR SCIENCE ABSTRACTS

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GENERAL

ATOMIC BOMBS AND WARFARE
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THE CUMULATIVE EFFECTS OF THERMONUCLEAR
EXPLOSIONS ON THE SURFACE OF THE EARTH.
Charles-Noël Martin. Translated from Compt. rend. 239,
1287-9(1954). 3p. (AEC-tr-1986)

Thermonuclear explosions involve orders of magnitude
which are significant on a global scale. Different cumu-
lative effects were considered: chemical, radioactive, and
climatic. These phenomena are irreversible, and the
equilibrium of certain planetary and living characteristics
will be influenced beyond the threshold reached with about
ten explosions. Different experimental proofs are sug-
gested. (auth)

BIOLOGY AND MEDICINE

AEROSOLS
819
Knolls Atomic Power Lab.
SIZE DISTRIBUTION OF PARTICLES PRODUCED BY
FISSION PRODUCT SOURCE PILOT PLANT. J. J.
Fitzgerald and C. G. Detwiler. Nov. 11, 1954. 24p.
Contract W-31-109-eng-52. (KAPL-1232)

An analysis of the size distribution of the tracer product
which was produced by the Fission Product Source Pilot
Plant was characterized by a geometric mean size of 0.014
micron and the geometric standard deviation of 2.4 microns.
The particle size distribution was made by using a light and
an electron microscope. Autoradiographic studies indicated
that the largest portion of the activity was emitted by the
particles less than 0.1 micron in size. (auth)

RADIATION EFFECTS
820
Radiological Research Lab., Columbia Univ.
X-IRRADIATION OF THE FROG EMBRYO: GROSS
EFFECTS. Roberts Rugh, Sept. 1, 1954. 26p. Contract
AT-30-1-GEN-70. (NYO-474)

The uterine egg and the early stages of development of
the frog from fertilization through neurulation were ex-
posed as whole embryos to x rays from 180 to 2880 r and
were studied for developmental effects. Development was
never stopped immediately by any dose used. Development
was stopped by bringing about certain abnormalities such
as stunting, microcephaly, flexure, edema, exogastrulation,
and amorphous development at some time subsequent to
x irradiation. X irradiation at early stages did not prevent
the subsequent development of external cilia, nor did it
prevent the hatching process except in those cases where
the embryo was killed prior to the stage of hatching. At
any exposure level there was a wide range of variation in

the response, even though, for instance, all eggs were in
the 2-cell stage. This is an expression of biological
variation in response which may in turn be an expression of
variations in biological dynamics at the moment of exposure
even though there appears to be morphological similarity.
The recently inseminated (fertilized) egg is the most
radiosensitive stage. This is probably because of the con-
dition of, and the movement of, the paternal and maternal
chromosomes toward each other so that the interference or
damage to one set of chromosomes might affect subsequent
development. The results of this study emphasize the im-
portance of the dynamic rather than the morphological
phases of early development with respect to radiosensitivity
at any particular time. In embryonic development, there-
fore, it is probably the differentiating rather than the
merely dividing cell that is so radiosensitive. (auth)
821
BIOLOGICAL LEVELS OF THE RADIOSENSITIVITY OF
SOMATIC CELLS. A. Glücksmann (Strangeways Research
Lab., Cambridge, England). Brit. J. Radiol. 27, 660-9(1954)
Dec.

Factors affecting the radiosensitivity of somatic cells are
reviewed, and a concept linking radiosensitivity and hor-
monal factors is discussed. (C.H.)
822
THE LETHAL EFFECTS OF X RAYS ON THE CHICK
EMBRYO. THE MODE AND TIME OF DEATH AND THEIR
BEARING ON THE DETERMINATION OF THE LD_{50}. John
Boland (Univ. of California School of Medicine, San Fran-
cisco). Brit. J. Radiol. 27, 680-7(1954) Dec.

The lethal effects of x radiation on the chick embryo are
reexamined, and a method of estimation of the LD_{50} is de-
scribed. (C.H.)
823
RADIOBIOLOGICAL STUDIES WITH TRADESCANTIA AT
NUCLEAR TEST DETONATIONS. Alan D. Conger (Oak
Ridge National Lab., Tenn.). Am. Naturalist 88, 215-24
(1954) July-Aug.

The yield of chromosome aberrations in Tradescantia as a
function of dose was used to determine the radiobiological
effects of mixed radiations from a nuclear test detonation.
The correlation between instrumentally measured dose and
biologically estimated dose is discussed. (C.H.)
824
VISIBLE AND LETHAL MUTATIONS IN DROSOPHILA.
George H. Mickey (Northwestern Univ., Evanston, Ill. and
Oak Ridge National Lab., Tenn.). Am. Naturalist 88, 241-
55(1954) July-Aug.

Fast neutrons from the Oak Ridge National Laboratory
86-inch cyclotron and from nuclear test devices (about 1
Mev) are approximately four times as efficient in producing
specific loci mutations at the res markers in the third
chromosome of Drosophila melanogaster as are x rays of
250 kvp. Dominant visible mutations are produced at a much
higher rate per rep of neutrons than per r of x rays, the
RBE of neutrons for all observed variants being from 6 to

37 and for the proved dominant mutations from 3 to 22. The relative biological effectiveness of fast neutrons as compared to x rays in the production of dominant mutations likewise is quite high. Contrary to reports of previous investigators that fast neutrons are only about two-thirds as effective as x rays in producing sex-linked recessive lethal mutations, it was found that the neutrons have an RBE of 2. Dominant lethals are produced at a much higher frequency per rep of fast neutrons than per r of x rays, the RBE at lower doses being about 7 and at higher doses falling off to about 4. It appears, therefore, with all the biological criteria used to measure the genetic damage of radiations in Drosophila, that fast neutrons cause a much greater effect than do x rays. (auth)

825

THE RELATIVE EFFECTIVENESS OF NEUTRONS FROM A NUCLEAR DETONATION AND FROM A CYCLOTRON IN INDUCING DOMINANT LETHALS IN THE MOUSE. W. L. Russell, Liane B. Russell, and A. W. Kimball (Oak Ridge National Lab., Tenn.). Am. Naturalist 88, 269-86(1954) July-Aug.

Dominant lethality in the offspring of male mice exposed in lead hemispheres to neutron radiation from a nuclear detonation was determined for ten different doses by mating the males to unexposed females, dissecting the females at a late stage in pregnancy, and recording the number of living and dead embryos, resorption sites, and corpora lutea. Data from early matings and late matings were tabulated separately and compared with results from a similar experiment with fast neutrons from a cyclotron. (auth)

826

SURVIVAL AND MUTATION IN NEUROSPORA EXPOSED AT NUCLEAR DETONATIONS. K. C. Atwood and Frank Mukai (Oak Ridge National Lab., Tenn.). Am. Naturalist 88, 295-314(1954) July-Aug.

The conidia of Neurospora were exposed to the mixed radiations from nuclear devices at several stations, both inside and outside the seven-inch-thick lead neutron-shielding hemispheres. Data are presented on the survival of conidia under conditions of forced heterokaryosis, on supplemented medium, and on the frequency of nuclei carrying recessive lethal mutations. (C.H.)

827

HEMANGIOMA. AN EXPERIMENTAL AND MORPHOLOGICAL STUDY. T. Bali and J. Furth (Veterans Administration and Southwestern Medical Coll., Dallas, Texas). Oncologia 7, No. 3, 231-44(1954). (In English)

Three hemangioendotheliomas occurring in x-rayed mice have been studied in serial passages. One of these mimicked chorionepithelioma but on successive passages assumed angiomatous features. The second strain was benign and has not changed in the course of 7 years of subpassages except for an increase in its rate of growth. The third was malignant. The available evidence indicates that these neoplasms can be induced by x rays as well as other agents. The nature, pathogenesis and histogenesis of Kaposi's disease are discussed in the light of the conclusions derived from the transplantation studies. (auth)

828

DESTRUCTION OF THYROID GLAND OF ATLANTIC SALMON (Salmo Salar L.) BY MEANS OF RADIO-IODINE. Gilles La Roche and C. P. Leblond (McGill Univ., Montreal, Canada). Proc. Soc. Exptl. Biol. Med. 87, 273-6(1954) Nov.

Salmon parr may be completely thyroidectomized by ad-ministration of repeated doses of radio-iodine. Preliminary observations indicate that the absence of the thyroid gland does not influence the rate of growth of these animals, but reduces the superficial skin pigmentation and may impair the ability to survive a rise in water temperature. (auth)

829

ELECTROPHORESIS OF PLASMA PROTEINS AND ASCITIC FLUID OF DOGS WITH RADIATION CIRRHOSIS. Doris H. Clouet, Con O. T. Ball, George R. Meneely, and Paul F. Hahn (Thayer Veterans Administration Hospital; Vanderbilt Univ. Medical School; and Meharry Medical Coll., Nashville, Tenn.). Proc. Soc. Exptl. Biol. Med. 87, 362-5(1954) Nov.

A series of determinations of the electrophoretic patterns in plasmas of dogs whose livers have been irradiated following intravenous injection of radioactive colloidal gold are presented. These are compared to a similar control series. The irradiated animals had significantly lower serum albumins and significantly higher gamma globulin components. Some qualitative differences in the effect of age on level of the alpha$_2$ globulin are noted. Examination of ascitic fluid samples obtained from irradiated animals showed that all plasma protein fractions appeared in the ascitic fluid, with albumin, alpha$_2$ globulin, fibrinogen and and gamma globulin predominant. (auth)

830

INHIBITION OF INFLAMMATORY RESPONSE IN BETA-IRRADIATED SKIN. Georges Ungar and Evelyn Damgaard (Univ. of Illinois Coll. of Medicine, Chicago). Proc. Soc. Exptl. Biol. Med. 87, 383-6(1954) Nov.

Treatment of rat skin with beta rays depresses the local reaction to certain inflammatory stimuli. Response to histamine is not inhibited but the histamine liberator 48-80 fails to elicit a response within a few hours after irradiation. Histamine content of the skin is not diminished after beta irradiation. The results shown above suggest that beta rays act by interfering with a tissue protease system which plays an important role in the mechanism of inflammation. The inflammation-inhibiting action of beta rays may be applied to the early detection of radiation injury. (auth)

831

ALTERATIONS IN THE GLIAL CELLS FOLLOWING IRRADIATION OF THE BRAIN IN PRIMATES. Arthur Arnold and Percival Bailey (Univ. of Illinois Coll. of Medicine, Chicago). Arch. Pathol. 57, 383-91(1954) May.

The normal adult glial cell of the primate brain can be adversely affected by irradiations. The alterations in the function as well as the structure of the glial cells can be correlated with the total dose of radiation, the intensity of dose administration, uniformity of dose distribution within the tissue, and the duration of time of observation after irradiation. The clinical significance of these observations for the pathologist has been indicated. (auth)

832

INTOLERANCE OF THE PRIMATE BRAINSTEM AND HYPOTHALAMUS TO CONVENTIONAL AND HIGH ENERGY RADIATIONS. Arthur Arnold, Percival Bailey, and Roger A. Harvey (Univ. of Illinois Coll. of Medicine, Chicago). Neurology 4, 575-85(1954) Aug.

From experimental and clinical studies, the brainstem and hypothalamus of man and monkey appear to be intolerant to large doses of x rays from conventional x-ray equipment and to biologically equivalent doses of radiations from the betatron. The intolerance of the primate brainstem and hypothalamus to large doses of radiation is due to two

factors: these areas subserve many functions essential for survival, and these areas are much more radio-responsive than cortical areas. The primate brainstem and hypothalmus will also respond to moderate dosage of radiations. The significance of these observations was then considered with respect to the brainstem in brain tumor therapy, the possible potential damage to the brainstem in atomic radiations, when restricted to the head, and the effects of x irradiation of the pituitary-hypothalamic region on clinical disorders related to pituitary dysfunction. (auth)

833

EFFECTS OF X-IRRADIATION ON THE HYPOTHALAMUS: A POSSIBLE EXPLANATION FOR THE THERAPEUTIC BENEFITS FOLLOWING X-IRRADIATION OF THE HYPO-PHYSIAL REGION FOR PITUITARY DYSFUNCTION. Arthur Arnold (Univ. of Illinois Coll. of Medicine, Chicago). J. Clin. Endocrinol. and Metabolism 14, 859-68(1954) Aug.

The paraventricular and supraoptic nuclei of the hypothalamus are responsive to x irradiation. Since the hypothalamus, in particular the paraventricular and supraoptic nuclei, exerts a considerable influence over the function of the pituitary body, and since the pituitary body is reported to be relatively radioresistant, then perhaps the therapeutic benefits reported following x irradiation of the hypophysial region for pituitary dysfunction are due to the effects of x rays on the hypothalamus. (auth)

834

ON THE PRODUCED CHANGES IN THE LIVER OF RATS IRRADIATED WITH GAMMA RAYS. INCREASE OF LIVER WEIGHT AND THE AUGMENTATION OF INCORPORATED P^{32} IN THE PHOSPHOLIPIDS AND NUCLEOPROTEINS. Aleksandar D. Bećarević, Katica L. Kaćanski, and Desanka D. Mančić. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 4, 105-9(1954) June. (In English)

Experiments are described in which white rats are exposed to daily partial doses of 38.4 r of γ radiation. Effects observed included fall of body weight at first followed by a mild increase, increase of liver weight probably due to increased metabolism of proteins in the liver, and a great increase in fat metabolism. (M.P.G.)

835

EFFECT OF LINEAR ENERGY TRANSFER ON RADIATION INDUCED CHROMOSOME ABERRATIONS IN TRADESCANTIA MICROSPORES. Norman H. Giles (Oak Ridge National Lab., Tenn.) and C. A. Tobias (Univ. of California, Berkeley). Science 120, 993-4(1954) Dec. 10.

836

ERYTHEMA EFFECTS OF A PURE BETA EMITTER (STRONTIUM 90) ON HUMAN SKIN. Victor H. Witten, Earle W. Brauer, Vera Holmstrom, and Robert Loevinger (New York Univ., New York). J. Invest. Dermatol. 23, 271-85(1954) Oct.

The clinical biologic effects produced by strontium 90 beta radiation in 19 subjects are recorded and evaluated. A Sr^{90} source in the form of a plaque was used with two adaptors designed to give different source-skin distances. One permitted a source-skin distance of 9.5 mm and the other a source-skin distance of 3.2 mm. Two waves of erythema were observed in most instances following exposure to the Sr^{90} source. A first wave appeared in 1 to 5 days. This was followed by a subsequent wave which appeared earlier for the applicator with the shorter skin distance, that is, in 32 to 59 days as compared to 58 to 73 days for the applicator with the longer source-skin distance. Observations indicate that the biologic effects of Sr^{90} beta radiation, as judged by the visible reactions produced, is influenced by the source-skin distance: the greater the source-skin distance, the greater the reactions for any given dose. Observations also suggest that the biologic effects of Sr^{90} beta radiation may be a function of depth dose: the greater the source-skin distance, the greater the depth dose and therefore the greater the biologic effects. Additional observations of clinical biologic reactions are recorded and discussed. (auth)

RADIATION HAZARDS AND PROTECTION

837

PROTECTION AGAINST IONIZING RADIATION. THE "RECOVERY FACTOR" IN SPLEEN AND BONE-MARROW. J. F. Loutit (Atomic Energy Research Establishment, Harwell, Berks, England). J. Nuclear Energy 1, 87-91(1954) Aug.

It has been shown that, among animals, mice at least can survive what would normally be a lethal dose of x radiation as a result of treatment after receiving the dose. Spleen and bone marrow are the therapeutic agents. The recent work designed to elucidate whether these tissues exert their effect through a cellular or humoral mechanism is reviewed. It is concluded, contrary to the majority opinion, that the cellular hypothesis has not been excluded and at the moment provides at least as good an explanation of the facts as the humoral theory. (auth)

838

INFLUENCE OF CORTISONE ON THE MORTALITY OF X-IRRADIATED ADRENALECTOMIZED MICE. George A. Santisteban, J. Z. Bowers, and T. F. Dougherty (Univ. of Utah Coll. of Medicine, Salt Lake City). Endocrinology 55, 794-807(1954) Dec.

The influence of cortisone in the acute x-irradiation syndrome was studied by making statistical comparisons of the cumulative mortality curves of groups of x-irradiated (650r whole-body) adrenalectomized CBA mice, some nontreated and others treated with intraperitoneal injections of graded doses of the hormone. Data are presented graphically and discussed. (auth)

839

BIO-FLAVONOIDS IN RADIATION INJURY. III. CLINICAL STUDIES. Isidore Arons, John Freeman, and Solomon Weintraub (Harlem City Hospital, New York City). Brit. J. Radiol. 27, 696-8(1954) Dec.

Four hundred three patients affected with malignant growth and treated by x irradiation received bio-flavonoid therapy. In these cases the compound was administered in adequate doses, 600 mg daily, for five to seven days prior to the initial exposure and during the whole course of radiation therapy. In this group, there was marked increase in the tolerance to radiation as compared with 613 control cases receiving no bio-flavonoids. (auth)

840

ADMINISTRATIVE PROBLEMS IN RADIATION PROTECTION. Irving R. Tabershaw and Saul J. Harris (New York State Labor Department, New York). Nucleonics 12, No. 12, 8-13(1954) Dec.

In the light of new legislation and wider application of radiation, health and safety regulations on federal, state, local, and industrial levels are reviewed. Existing codes are analyzed, and items essential to formulation of effective radiation protection codes are suggested. (L.T.W.)

841

PROTECTIVE EFFECT OF BREPHOPLASTIC GRAFTS OF BONE MARROW AGAINST THE ACTION OF X RADIATION IN MICE. Raoul-Michel May and Noubar Arpiarian. Compt. rend. 239, 1151-3(1954) Nov. 3. (In French)

Favorable results on the radiation protection of mice were obtained by grafting bone marrow from new-born mice into the adult animal. (K.S.)

842

THE EFFECTS OF PRE- AND POSTIRRADIATION CENTRIFUGATION ON THE CHROMOSOMES OF TRADESCANTIA AND VICIA. Sheldon Wolff and R. C. von Borstel (Oak Ridge National Lab., Tenn.). Proc. Natl. Acad. Sci. U. S. 40, 1138-41(1954) Dec.

It has been observed that in Tradescantia microspores and in Vicia seed preirradiation centrifugation decreases the number of aberrations as compared to noncentrifuged controls. Postirradiation centrifugation increases aberrations, provided that the centrifuging occurs before the chromosome breaks rejoin. These phenomena have been explained on the basis of physically induced compression or movement of the chromosomes. Cells of Tradescantia irradiated in nitrogen show no increase of aberration yield caused by centrifugation. This is explained on the basis that rejoining occurs in a shorter time after anaerobic irradiation, as is the case in Vicia. (auth)

RADIOTHERAPY

843

RADIOACTIVE COBALT AS A RADIUM SUBSTITUTE AND AS A GAMMA SOURCE FOR INTERSTITIAL, INTRACAVITARY AND PLAQUE APPLICATIONS. Isadore Meschan (Univ. of Arkansas School of Medicine, Little Rock). Rev. mex. radiol. 8, 21-32(1954) Jan.-Mar. (In English)

Data are presented from a comparison of the effects of γ radiation from Co^{60} and from radium applied in identical doses to the two sides of the abdominal skin of rabbits. Results are described and the feasibility of using radioactive Co as a radium substitute and as a γ source for interstitial, intracavitary, and plaque applications is discussed. (C.H.)

TOXICOLOGY STUDIES

844

Chemical Corps Medical Labs., Army Chemical Center
LITERATURE SURVEY ON TOXICITY OF BORIC ACID AND SODIUM TETRABORATE (BORAX). Anne M. Kunkel. Sept. 1950. 13p. (MLSR-2)

A literature survey reveals that boric acid and borax are relatively non-toxic to both laboratory animals and humans. Calculations made from data of the Gassing Section show that diborane is probably somewhere between 250 and 15 times as toxic as boric acid. In man, death may occur within about 36 hrs after ingestion of 2 to 5 gm of boric acid or 15 to 30 gm of borax. (auth)

845

INDUSTRIAL HYGIENE. H. H. Schrenk. Ind. Eng. Chem. 46, 99A-102A(1954) Dec.

A review of literature on the toxicity of Zr, zircon and Zr citrate, carbonate, gluconate, acetate, chloride, nitrate, and sulfate salts administered orally and intraperitoneally is given. In general, the results indicated a very low order of toxicity for Zr compounds when administered orally. The toxicity was greater for the same compound if given intra-

peritoneally but was still low. Diagnostic and therapeutic uses of Zr metal and Zr compounds and the effects of acute LD_{50} toxic doses of La, Ta, and Nb compounds are also briefly reviewed. (J.A.G.)

TRACER APPLICATIONS

846

Atomic Energy Project, Univ. of Calif., Los Angeles
THE EFFECTS OF CALCIUM AND PHOSPHATE IN FOODS ON RADIOSTRONTIUM ACCUMULATION. N. S. MacDonald, Patricia C. Spain, Florita Ezmirlian, and Donald E. Rounds. Dec. 7, 1954. 20p. Contract AT-04-1-GEN-12. (UCLA-317)

Each of a series of common food materials, accompanied by a fixed dose of $Sr^{90}-Y^{90}$, was administered by gavage to rats. The femurs were removed forty-eight hours later and analyzed for radiostrontium activity. The Ca and PO_4 contents of each of the materials was also determined. There was a clearcut reduction of Sr^{90} bone burden with increase of ingested Ca. The reduction of Sr^{90} bone burden was even more pronounced if the PO_4 as well as the Ca dose was elevated. Milk powder was an exception. Accumulation of Sr^{90} was enhanced by the presence of milk even though the dose was rich in Ca and PO_4. Some speculations concerning the inter-relationships of orally administered Ca and Sr^{90} are presented. Assuming that Sr^{90} acted as a 'tracer' for Ca, the results imply that the percentage of an oral dose of Ca which deposits in the skeleton decreases as the size of the dose increases. It is suggested that the potential hazards from ingestion of foods contaminated with radiostrontium are somewhat diminished in proportion to the Ca and PO_4 concentrations existing in the foods naturally or by enrichment. (auth)

847

Atomic Energy Project, Univ. of Rochester
ON THE MECHANISM OF SKELETAL FIXATION OF RADIUM. W. F. Neuman, J. B. Hursh, E. S. Boyd, and H. C. Hodge. Oct. 11, 1954. 22p. Contract W-7401-eng-49. (UR-365)

A series of studies was made of the incorporation of radium from approximately physiological solutions by the prototype mineral of bone. It was established that the fixation process in vitro involved a nonequivalent ionic exchange of radium ions for calcium ions residing in the surfaces of the microcrystalline solid phase. The significance of this ion exchange mechanism in the skeletal fixation of radium in vivo is discussed. (auth)

CHEMISTRY

848

Los Alamos Scientific Lab.
THE PREPARATION AND SOME PROPERTIES OF MAGNESIUM HYDRIDE. F. H. Ellinger, C. E. Holley, Jr., B. B. McInteer, D. Pavone, R. M. Potter, E. Staritzky, and W. H. Zachariasen. [1954?] 5p. Contract [W-7405-eng-36]. (AECU-2970)

The optimum conditions for the preparation of MgH_2 by the reaction of hydrogen on magnesium metal were investigated. Crystal structure, refractive index, and decomposition pressure are reported. (auth)

849

Institute for the Study of Rate Processes, Univ. of Utah
A REACTION RATE STUDY OF THE SOLUTION OF
CUPRITE IN SULFURIC ACID. Milton E. Wadsworth and
Dorab R. Wadia. Feb. 2, 1954. 22p. Contract AT(11-1)-
82; Technical Report No. 9. (AECU-2971)

The rate of reaction of cuprite was measured in a series
of sulfuric acid solutions, from which oxygen had been ex-
cluded, at various concentrations and temperatures. The
over-all reaction $Cu_2O + H_2SO_4 \rightarrow Cu^{++} + Cu^\circ + H_2O + SO_4$
may be quantitatively explained by two simultaneous rate
reactions involving not only H^+ but also the hydrolytic
absorption of H_2SO_4. The results indicate the importance of
considering surface mass balance relationships associated
with heterogeneous surface reactions. (auth)

850

Michigan Univ.
FUNDAMENTAL RESEARCH ON ISOTOPIC REACTIONS.
TECHNICAL REPORT. OXYGEN-18 ISOTOPE EFFECT IN
THE REACTION OF OXYGEN WITH COPPER. Richard B.
Bernstein. Dec. 1954. 24p. Contract AT(11-1)-321.
(AECU-2974)

The fractionation of O^{18} in the reaction of copper with
oxygen of natural isotopic composition has been measured
over the temperature range 68 to 256°C. The oxide films
(estimated thicknesses varying from 150 to 2500 A) were
removed for O^{18} assay by treatment with hydrogen at 350°C.
Using the CO_2 equilibration technique, the O^{18}/O^{16} ratios for
the resulting water samples were determined mass
spectrometrically and compared with the ratio for a ref-
erence sample of water prepared from the original oxygen
gas. The direction of the fractionation indicated that O_2^{16}
reacts preferentially compared to $O^{16}O^{18}$. The isotope
effect appeared to be independent of the oxygen pressure
over the limited range studied (2 to 25 cm Hg). The magni-
tude of the fractionation factor was 2.0% at 150°C, with a
small negative temperature coefficient. From this it was
possible to estimate a value of $\Delta E_{act.} = 17$ cal/mole,
which may be compared with the calculated isotopic zero-
point energy difference of 64 cal/mole. The theoretical
implications of the experimental results are discussed.
(auth)

851

Ames Lab.
THE KINETICS OF THE HYDROGEN PEROXIDE OXIDA-
TION OF SELENIOUS ACID. Francis J. Hughes and Don S.
Martin. June 1954. 40p. Contract W-7405-eng-82.
(ISC-521)

The rates of disappearance of selenious acid and hydrogen
peroxide have been measured in aqueous acidic solutions
containing the two species. Temperature variation of these
rates has been observed between 67.7 and 82.3°C. The rate
law has been determined for the oxidation of selenious acid
by hydrogen peroxide. The decomposition of hydrogen
peroxide in aqueous acidic solution has been shown to be
inhibited by the presence of a small amount of selenious
acid. Another made of decomposition of hydrogen peroxide
has been shown to exist and has been found to be first order
in selenious acid. At least four rate terms required to
account for the decomposition rate of the peroxide. The
evidence indicated that the reactions which involved seleni-
ous acid were homogeneous. The selenious acid oxidation
is believed to be nonfree radical in character while the
extra hydrogen peroxide decomposition which accompanies

it is believed to proceed through a free radical chain
mechanism. (auth)

852

North American Aviation, Inc.
THEORY OF THE REACTION BETWEEN ALKALI METAL
AND ALKALI HALIDES WITH APPLICATION TO THE
SYSTEM K−KCl. Donald R. Westervelt. Dec. 15, 1954.
34p. Contract AT-11-1-BEN-8. (NAA-SR-1050)

The properties of a system consisting of colloidal alkali
metal particles in thermal equilibrium with a crystalline
alkali halide are considered in detail, with particular ref-
erence to the system K−KCl. It is shown that in the
system K−KCl, the particles most probably are about 20 A
in size and consist of liquid metal compressed about 15%
by surface tension. A theory of the three−phase reaction
between a liquid metal, vapor, and crystal is developed
more completely than heretofore and is shown to be in
quantitative agreement with recent experimental results.
A value of −0.10 ev found by Rögener for W_f, the work done
in forming an F−center from a K atom in the vapor, is
shown to lead to quantitative inaccuracy in the predicted
ratio of F−center to vapor concentration, whereas a value
of −0.5 ev deduced from more recent experiments leads to
an acceptable value for this ratio. A theoretical calculation
of W_f is reviewed, and it is concluded that the existing
inaccuracy is due to an unsatisfactory value for χ the
electron affinity of KCl. A recent report that the additive
coloring process is not reversible is discussed, and it is
shown that further experiments are essential before the
mechanism and the reversibility of the additive coloring
process can be considered established. It is concluded that
the heats of reaction which are observed are in substantial
agreement with a theoretical prediction based on the
assumption that one reactant is colloidal metal embedded
in the alkali halide crystal but that current interpretations
of the resulting optical absorption phenomena require re-
vision to incorporate a more realistic view of the physical
state of the metal in these particles. (auth)

853

National Bureau of Standards
A SUMMARY REPORT OF INVESTIGATIONS OF THE
SYSTEM Mg/LiNO$_3$, KCl, K$_2$CrO$_4$/Ag. Bernard Rubin and
Marjorie S. Malmberg. Jan. 22, 1954. 39p. (NBS-3081)

A summary of work done in investigating various aspects
of the galvanic cell Mg/LiNO$_3$, KCl, K$_2$CrO$_4$/Ag at 350°C is
given. Effects of variables such as electrolyte composition,
temperature, surrounding atmosphere, and electrode com-
partmenting are described. Chemical side reactions and
electrode reactions are discussed. The electrochemical re-
action which is the source of emf in the cell is considered to
be $Mg + 2 Ag^+ + O^= \rightarrow MgO + 2 Ag$. Evidence supporting
this conclusion is given. The theoretical value of the
standard emf as calculated from thermodynamic data is
1.816 volts at 350°C. The measured emf for the laboratory
cell at 350°C is 1.65 volts. The cell voltage is dependent
upon chemical reactions at the electrodes which alter the
concentration of the ions to which the electrodes are re-
versible. A vigorous chemical reaction between the magne-
sium electrode and the electrolyte makes precise studies of
the coulombic relationship of the cell difficult and gives a
cell which is highly inefficient. (auth)

854

Stanford Research Inst.
DETERMINATION OF THE MECHANISM OF THE IN-

CREASE OF VISCOSITY OF ORGANOSILICON COMPOUNDS AT HIGH TEMPERATURES. O. F. Senn. June 1954. 72p. Contract AF 33(616)-168. (WADC-TR-54-339)

Oxidation of alkoxy- or aryloxysilanes is inevitably accompanied by hydrolysis. Oxidation rates were determined for tetraphenoxysilane, tetra(2-ethylhexoxy)silane, hexa(2-butoxy)disiloxane, and a series of isomeric tetrapentoxysilanes. The presence of 1020 steel, Ti, and Cu during oxidation did not produce large changes in rate as compared to the rate for the test material alone. The hydrolysis of tetraaryloxy- and alkoxysilanes apparently proceeds through a stepwise degradation. The rate of hydrolysis is affected largely by structure, being very rapid for tetraphenoxysilane, less rapid for tetra(2-ethylhexoxy)silane, and slow for branched tetrapentoxysilanes. Pyrolysis is probably the least important factor in the degradation of the tetraaryloxy or alkoxysilanes. No significant degradation was observed with tetraphenoxysilane while tetra(2-ethylhexoxy)silane was degraded only slightly by thermal cracking of the 2-ethylhexyl group. (auth)

855

ON THE PREVENTION OF FOGGING IN CONDENSATION OF VAPORS FROM GAS STREAMS. (Über Die Verhinderung Der Nebelbildung Bei Kondensation Von Dämpfen Aus Gasströmen). Heinz Theile. Translated from Erdöl u. Kohle 5, 407-12(1952). (AEC-tr-1980)

Several inexpensive procedures are discussed for the prevention of fogging or mists in cooled gas-vapor streams. The problem is approached by a fundamental analysis of the condensation process. (K.S.)

856

THE ELECTROREDUCTION OF ANIONS. A. N. Frumkin and G. M. Florianovich. Translated by Vera N. Brewus from Doklady Akad. Nauk S.S.S.R. 80, 907-10(1951). 6p. (AEC-tr-1984)

Results are presented from a study of the electroreduction of the anions $S_2O_8^=$, $Fe(CN)_6^{-3}$, $PtCl_6^=$, $PtCl_4^=$, $IrCl_6^=$, $RhCl_6^=$, and MnO_4^- on a mercury cathode. Results and theories governing the electroreduction of anions are discussed. (C.H.)

857

TERNARY TRANSITION METAL OXIDE PHASES OF THE FLUORITE STRUCTURE. Nils Schönberg (Univ. of Uppsala, Sweden). Acta Chem. Scand. 8, No. 8, 1347-50(1954).

Ternary $A-B-O$ phases of the C1 type, where A and B are transition metals, have been prepared by different methods and investigated by x-ray methods. The general formula of these compounds is proposed to be $A_K^{z+}B_{4-K}^{4+}O_{8-K/2(4-z)}$, where A = Fe, Co, and Ni in combination with B = Ti and A = V, Cr, Mo, W, and Mn in combination with B = Zr; K varies to some extent within the approximate limits $1 \leq K < 2$, and z^+ designates the valency of the A component. All the oxides are black and have the same axial lengths, varying between a = 5.09 A and a = 5.13 A, which corresponds to mean interatomic A_xB-O and $O-O$ distances of 2.21 A and 2.56 A, respectively. The oxides are stable at room temperature in spite of unfavorable geometrical conditions for the formation of a lattice of the C1 type. (auth)

858

ON METALLIC PHASES IN THE Ti-P-O AND Zr-P-O SYSTEMS. Nils Schönberg (Univ. of Uppsala, Sweden). Acta Chem. Scand. 8, No. 8, 1460-5(1954).

The metallic corners of the Ti-P-O and Zr-P-O systems (nonmetal/metal ratio $\leq$ 1) have been investigated by means of x-ray methods. The structures of the monophosphide phases are known earlier. Ti_3P is isomorphous with Fe_3P. Attempts to prepare ZrO from Zr and ZrO_2 were in vain, but this phase (B1 type) could be identified in samples where Zr was oxidized by means of steam in the presence of hydrogen or with oxides of Fe, Co, and Ni. The ternary metallic phases Ti_3PO_2 and Zr_3PO_2 are isomorphous with each other and are of an interstitial structure type with the nonmetal atoms in ordered positions at the centers of metal atom octahedra. The three metal atoms in the hexagonal unit cell are displaced to a slight extent from the positions corresponding to a cubic close-packing. (auth)

859

HYDRODYNAMIC PROPERTIES OF UREA-DENATURED FIBRINOGEN. H. A. Scheraga, W. R. Carroll, L. F. Nims, E. Sutton, J. K. Backus, and J. M. Saunders (Cornell Univ., Ithaca, N. Y.; National Institutes of Health, Bethesda, Md.; and Brookhaven National Lab., Upton, N. Y.). J. Polymer Sci. 14, 427-42(1954) Nov.

The hydrodynamic properties of native and urea-denatured fibrinogen have been investigated, primarily to examine further the suggestion, based on a consideration of data for horse serum albumin, that urea denaturation may involve swelling instead of increased asymmetry. A sedimentation-diffusion and also a light-scattering molecular weight determination at the isoelectric point indicate that 6M urea causes neither splitting nor aggregation of the native protein in the denaturation process. The observed increase in the intrinsic viscosity and frictional coefficient upon denaturation can be interpreted in terms of an equivalent hydrodynamic ellipsoid of approximately the same shape but of a volume which is approximately 1.7 times that for the native protein. The effective volume appears to be slightly dependent on pH with a minimum at the isoelectric point. It thus appears that the urea denaturation of bovine fibrinogen, like that of horse serum albumin, may involve swelling. There is no indication in the case of either protein that increased asymmetry is involved in accounting for the frictional behavior of the denatured substances. (auth)

860

REACTIONS OF ATOMIC OXYGEN WITH MOLECULAR OXYGEN. Richard A. Ogg, Jr. and William T. Sutphen (Stanford Univ., Calif.). Discussions Faraday Soc., No. 17, 47-54(1954).

Oxygen gas highly enriched in O^{18} isotope has been used for rate studies of the exchange reaction $O^{16}O^{16} + O^{18}O^{18} \rightleftharpoons 2O^{16}O^{18}$. The relative proportions were followed by mass spectrometer analysis. Added isotopically normal ozone is found to catalyze attainment of this equilibrium, the reaction being very rapid in comparison with O^{18} exchange between O_2 and O_3. This precludes the direct O atom transfer reaction between O_2 and O_3 as being appreciably involved. The only alternative appears to be the ultra-rapid exchange reactions exemplified by $O + OO^{18} \rightarrow OO + O^{18}$. Vagaries in the dissociation of ozone make a precise determination of the rate constant very difficult, but an activation energy of practically zero and a "normal" frequency factor somewhat less than 10^{12} mole^{-1} cm^3 sec^{-1} appear indicated. Some uses of the system as a reagent for detecting production of O atoms are discussed. The present study suggests that at low pressures the concentration of O atoms exceeds that corresponding to equilibrium with O_3 and O_2, an effect attributed to energy chains. (auth)

861

EFFICIENCY OF CERTAIN CATALYSTS IN THE EX-
CHANGE $H_2O + HD$. Pavle Savic, Slobodan V. Ribnikar,
and Natalija N. Dogramadzi (Institut de Sciences Nucleaires,
"Boris Kidrich", Belgrade). Bull. Inst. Nuclear Sci.
"Boris Kidrich" (Belgrade) 4, 25-30(1954) June. (In
French)

The catalytic efficiency of Pt, reduced $NiWO_4$, $ZrOCr_2O_3$,
$MnOCr_2O_3$, Cr_2O_3, and Fe_3O_4 at 110°C in the exchange re-
action $H_2O + HD$ is compared. In addition, the efficiency of
Pt and $NiWO_4$ at 20°C was measured. At 110°C, the best
catalyst was found to be $NiWO_4$. The speed of the reaction
with Pt was too large to measure. At 20°C, the reaction
activity of $NiWO_4$ was greatly reduced. (tr-auth)

862

ENTRAINMENT OF RADIOPHOSPHORUS (P^{32}) ON COPPER
SULPHIDE. K. R. Kar and L. Kasturi Rangan (Univ. of
Delhi, India). J. Sci. Ind. Research (India) 13, 691-3(1954)
Oct.

During a chemical separation of radiophosphorus (P^{32})
from copper (on which it was deposited electrolytically) by
precipitation of copper as CuS, a measurable amount of P^{32}
was found to be entrained in the CuS precipitate and could
not be removed by washing according to standard analytical
procedure. Of the several wash solutions tried alkaline
polysulfide solution was found to remove almost completely
the entrained P^{32}. The observed effect is presumably due to
the formation, in tracer quantity, of a sulfide of P^{32}, and its
subsequent entrainment with the CuS precipitate. A mech-
anism for the formation of such a compound has been sug-
gested. (auth)

863

TEMPERATURE DEPENDENCE OF COMPRESSION OF
LINEAR HIGH POLYMERS AT HIGH PRESSURES. Charles
E. Weir. J. Research Natl. Bur. Standards 53, 245-52
(1954) Oct.

Pressure-volume-temperature data for polyethylene,
polytetrafluoroethylene, polymonochlorotrifluoroethylene,
polyvinyl fluoride, polyvinylidene fluoride, polyvinyl alcohol,
a copolymer of ethylene-tetrafluoroethylene (1:1), and a
polyester are reported over the range 20° to 80°C and 1 to
10,000 atmospheres. Empirical equations of state for some
of the polymers are derived. Internal-energy changes were
calculated for most of the polymers studied. (auth)

864

THE IDENTIFICATION OF SOLVATED ELECTRONS AND
RADICALS IN RIGID SOLUTIONS OF PHOTOÖXIDIZED
ORGANIC MOLECULES; RECOMBINATION LUMINE-
SCENCE IN ORGANIC PHOSPHORS. Henry Linschitz,
Myron G. Berry, and Donald Schweitzer (Syracuse Univ.,
N. Y.). J. Am. Chem. Soc. 76, 5833-9(1954) Nov. 20.

Rigid solutions of alkali metals in solvents containing
methylamine show an absorption peak at 6000 A. Upon
illumination, a new band appears in the near infrared while
the 6000 A peak diminishes. The new band is attributed to
incompletely solvated electrons. This same infrared band
is found in illuminated rigid solutions of easily oxidized
organic molecules, indicating, in agreement with previous
work of Lewis and Lipkin, that photo-ejection of electrons
has occurred. Upon slight softening of the solvent, solutions
of such organic molecules frequently emit light (delayed
luminescence). This luminescence can be maintained for
hours if the solvent viscosity is properly controlled. The
phenomenon is quite general and occurs in a wide variety of

molecules. Evidence is presented which establishes that the
luminescence is due to triplet states arising from recombi-
nation of radicals and trapped or solvated electrons, both
formed originally by photoöxidation of the parent molecule.
(auth)

865

SYMMETRICAL SEMIQUINONE FORMATION BY REVERS-
IBLE PHOTOÖXIDATION AND PHOTOREDUCTION. Henry
Linschitz, Joseph Rennert, and T. Marc Korn (Syracuse
Univ., N. Y.). J. Am. Chem. Soc. 76, 5839-42(1954) Nov. 20.

In rigid solvents the illumination of either diphenyl-p-
phenylenediamine or the corresponding imine yields a new
substance having a characteristic absorption band at 7100
A. It is shown that this compound is the semiquinone of the
imine—amine oxidation-reduction couple. Thus, both photo-
öxidation and the inverse process of photo-reduction may
occur, leading to the same semiquinone. Similar behavior is
demonstrated for the hydroquinone—benzoquinone couple.
(auth)

866

THE DISSOCIATION OF FLUOBORATE ION IN ANHYDROUS
HYDROFLUORIC ACID. Martin Kilpatrick and Fred E.
Luborsky (Illinois Inst. of Tech., Chicago). J. Am. Chem.
Soc. 76, 5863-5(1954) Nov. 20.

In a previous paper, the equilibrium constants for the re-
action $Ar + HF \rightleftharpoons ArH^+ + F^-$ were reported for the methyl-
benzenes and shown to vary from 10^{-8} to 10^{-2}. When suf-
ficient boron trifluoride was introduced into the system, it
was shown that essentially all of the aromatic was converted
to the aronium ion and it was assumed that the addition of
BF_3 established a second equilibrium $F^- + BF_3 \rightleftharpoons BF_4^-$.
Further support for the existence of this equilibrium and
the calculation of this equilibrium constant are the subjects
of the present paper. This constant has been evaluated from
conductance studies on potassium fluoride and potassium
fluoborate, and from the change in conductance of potassium
fluoride on addition of boron trifluoride. Both methods give
a value approximating 2×10^2 at 20°, or 5×10^{-3} for the dis-
sociation of the fluborate ion. (auth)

867

THE CONDUCTANCE AND VAPOR PRESSURE OF BORON
TRIFLUORIDE IN ANHYDROUS HYDROFLUORIC ACID.
Martin Kilpatrick and Fred E. Luborsky (Illinois Inst. of
Tech., Chicago). J. Am. Chem. Soc. 76, 5865-8(1954)
Nov. 20.

The vapor pressure and conductance in liquid anhydrous
hydrofluoric acid have been determined for boron trifluoride
over a concentration range of 0.002 to 0.8 molar. The equi-
librium $BF_3 + 2HF \rightleftharpoons H_2F^+ + BF_4^-$ has been postulated and
the equilibrium constant calculated as a function of the con-
centration. The ion product of the solvent hydrofluoric acid
has been estimated to be less than 2×10^{-10}. In this solvent
the autoprotolysis reaction is $HF + HF \rightleftharpoons H_2F^+ + F^-$ (or
HF_2^-) and boron trifluoride displaces the equilibrium to the
right by the reaction $BF_3 + F^- \rightleftharpoons BF_4^-$. Boron trifluoride
can therefore be regarded as a co-acid and it would be of
interest to determine a corresponding equilibrium constant
for this last reaction, using other fluorides such as SbF_5,
AsF_5, etc., instead of BF_3. (auth)

868

AN IMPROVED METHOD FOR OBTAINING HIGH-PURITY
ZIRCONIUM AND HAFNIUM OXIDES. A. W. Henderson and
K. B. Higbie (Bureau of Mines, Albany, Oregon). J. Am.
Chem. Soc. 76, 5878-9(1954) Nov. 20.

A modification of the basic method of Herzfield is described which yields high-purity Zr and Hf oxides. (C.H.)

869

DETERMINATION OF THERMODYNAMIC EQUILIBRIUM CONSTANTS IN MIXED SOLVENTS. LeGrand G. Van Uitert and W. C. Fernelius (Bell Telephone Labs., Murray Hill, N. J. and Pennsylvania State Univ., State College). J. Am. Chem. Soc. 76, 5887-8(1954) Nov. 20.

A graph and tables of data at 30° from which the graph may be calculated are presented for water-dioxane systems from which pKd values and stability constants may be derived. (L.T.W.)

870

THE LINKAGE OF GLUCOSE IN COLIPHAGE NUCLEIC ACIDS. Elliot Volkin (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 76, 5892-3(1954) Nov. 20.

With the idea that the presence of glucose in the deoxyribonucleic acids (DNA) molecule somehow inhibited the action of the combined enzymes, an attempt was made to separate the products of such enzymatic hydrolysates by ion exchange and to identify them. Such experiments have shown that glucose is associated mole for mole with HMC in T4 DNA and that the glucose is probably linked as an O-glucoside to the 5-hydroxymethyl group of HMC rather than substituted for deoxyribose in the DNA sugar phosphate chain. The ratio of glucose to DNA phosphorus is about 0.17 in T4, T2 and T6 DNA. (L.T.W.)

871

C^{14} AND C^{13} INTRAMOLECULAR ISOTOPE EFFECTS IN THE DECARBOXYLATION OF LIQUID MALONIC ACID AT 140.5°. Peter E. Yankwich, Albert L. Promislow, and Robert F. Nystrom (Univ. of Illinois, Urbana). J. Am. Chem. Soc. 76, 5893-4(1954) Nov. 20.

Preliminary results are presented from mass spectrographic measurements to determine if the C^{13} and C^{14} intramolecular isotope effects in the decarboxylation of liquid malonic acid at 140.5° deviate from the absolute rate theory. (L.T.W.)

872

TITRATION STUDIES AS A MEANS OF CHARACTERIZING ANION-EXCHANGE RESINS. H. A. Strobel and R. W. Gabel (Duke Univ., Durham, N. C.). J. Am. Chem. Soc. 76, 5911-15(1954) Dec. 5.

Several recently developed anion-exchange resins of the substituted quaternary ammonium type with polystyrene-divinylbenzene matrices have been titrated in the hydroxide form in aqueous solution. The usefulness and reliability of the titration method of studying resinous exchangers are discussed in some detail. Nearly all resins showed from 1 to 5% capacity attributable to ternary amine or other types of weak bases. Qualitative correlations have been obtained between the structure of the resin ionic groups and the "basic strength" of the resin deduced from the shape of the titration curves. The titration behavior of the weaker quaternary ammonium resins considered as polyelectrolytes was found to be described by $pH = pK - n \log (1-\alpha)/\alpha$ over a limited range, where pK and n are constants and α is the degree of neutralization. Values of n of 1.3 to 1.5 were obtained in the absence of added salt. (auth)

873

A CHLOROPHYLL SUBSTANCE POSSESSING A SPECTRUM VERY SIMILAR TO THAT OF CHLOROPHYLL-b. Simon Freed, Kenneth M. Sancier, and Alfred H. Sporer (Brookhaven National Lab., Upton, N. Y.). J. Am. Chem. Soc. 76, 6006-8(1954) Dec. 5.

A chlorophyll substance is obtained along with chlorophyll-b' when chlorophyll-b has been heated in solvents and also without solvent, in the absence of oxygen and water. Its spectrum and its fluorescence and solvation properties are almost identical with those of chlorophyll-b. Despite the fact that it does not undergo the Molisch phase test, reasons are advanced that the three substances, chlorophyll-b, chlorophyll-b', and the new substance, may constitute the three long discussed possible tautomers of chlorophyll-b whose structures may be written for the chlorophyll molecule by bonding magnesium atom in turn to three different pairs of pyrrol nitrogen atoms. There are indications that a corresponding substance exists in the chlorophyll-a series also and it is tentatively proposed that these substances be known as chlorophyll-b" and chlorophyll-a". (auth)

ANALYTICAL PROCEDURES

874

Atomic Energy Research Establishment, Harwell, Berks (England)
SOME ANALYTICAL ASPECTS OF GAMMA SPECTROSCOPY. L. Salmon. May 29, 1954. 15p. (AERE-C/M-206)

It is shown that a gamma spectrometer may be used for quantitative estimation of activity using only a single standard of known energy and disintegration rate provided branching ratios, internal conversion factors, etc., are known. Examples show that estimation of simple mixtures may be made without chemical separation. The instrument may thus be used as an aid to radiochemical analysis. (auth)

875

Ames Lab.
A TITRIMETRIC DETERMINATION OF THORIUM. John J. Ford and James S. Fritz. June 1954. 47p. Contract W-7405-eng-82. (ISC-520)

A rapid, accurate method for thorium is proposed in which thorium is titrated with a standard solution of ethylenediaminetetraacetic acid (EDTA). Alizarin Red S serves as the indicator, a sharp change from pink to yellow marking the end point of the titration. The method is selective for thorium although several cations and anions interfere. A preliminary extraction of thorium nitrate by mesityl oxide provides an excellent separation of thorium from most interfering ions. A study of thorium complexes with Alizarin Red S was made. It was found that a 1:1 complex and probably a 1:2 complex is formed. The stability complex for the 1:1 complex was found to be 6.7×10^6 at pH 3.0. (auth)

876

Los Alamos Scientific Lab.
COLLECTED RADIOCHEMICAL PROCEDURES. D. P. Ames, J. W. Barnes, N. A. Bonner, W. H. Burgus, G. A. Cowan, P. B. Elkin, G. P. Ford, J. S. Gilmore, E. J. Lang, M. A. Melnick, C. O. Minkkinen, H. A. Potratz, R. J. Prestwood, J. E. Sattizahn, T. T. Shull, and C. W. Stanley—Jacob Kleinberg, comp. Sept. 10, 1954. 227p. Contract W-7405-eng-36. (LA-1721)

The properties of the chemical elements are discussed o on the basis of electronic configuration. Procedures for the separation from fission product material and radio-

chemical determination of Be, Na, P, Cl, Ca, Sc, Cr, Fe, Co, Ni, Ge plus As, Ge, As, Rb, Y, Zr, Nb, Mo, Ru, Pd, Ag, Cd, In, Sn Sb, Cs, Ba, Ce, Eu, W, Au, Tl, Th, and U and the preparation of carrier-free UX_1 (TH^{234}) tracer are given. (cf LA-1566.) (J.A.G.)

877

Research Labs., Lovelace Foundation for Medical Education and Research, Albuquerque
CALIBRATION OF THE LILLY-ANDERSON-HERVEY NITROGEN METER (WITH SPECIAL REFERENCE TO THE INFLUENCE OF WATER VAPOR AND CO_2). (School of Aviation Medicine, Project No. 21-1201-0007, Report No. 3). Nils P. V. Lundgren, Clayton S. White, and Walter M. Boothby. Mar. 1954. 17p. Contract [AF33(038)-13244]. (NP-5414)

The Ekeroot modification of the Lilly-Anderson-Hervey nitrogen meter was calibrated using gas mixtures of N_2, O_2, CO_2, and H_2O. The meter showed no specific response to steam or pure oxygen at operating pressures of the discharge tube ranging from 40 to 2,900 microns. A specific response to near 100 percent CO_2 and 36 percent CO_2 (in oxygen) was recorded at discharge tube pressures between 50 and 500 microns, with the maximum occurring at 100 microns. At discharge tube pressures above 500 microns, using gas mixtures of nitrogen and oxygen with or without CO_2, the response of the nitrogen meter to a variation in the partial pressure of N_2 was different for dry and for wet gas (H_2O vapor 21 to 27 mm Hg). The response to "dry" gas was always higher than for "wet" gas. The variation in response of the N_2 meter associated with the presence or absence of CO_2 was consistent with the dilution or concentration of nitrogen, respectively, whether the test gas was "wet" or "dry". In contrast, the concentration or dilution of nitrogen associated with wetting or drying the test gas produced a variation in response which could not be predicted on the basis of the partial pressure of water vapor in the main air circulating system, possibly because the expansion of the gas mixture as it passed through the needle valve altered the temperature of the gas at that point sufficiently to condense some of the water vapor. (auth)

878

Department of Mines and Technical Surveys, Mines Branch (Canada)
ROUTINE RADIOMETRIC ANALYSIS FOR URANIUM IN ORES. G. G. Eichholz. Nov. 9, 1954. 12p. (NP-5439; TR-120/54)

Simple apparatus for the radiometric assaying of radioactive ores in the field and in mill assay offices is described. The use of portable and line-operated rate meters is illustrated, and the choice of suitable Geiger tubes and equipment discussed. Practical procedure for β and γ assaying is outlined, and factors determining the sensitivity of the unit are explained. (auth)

879

Chalk River Project (Canada)
PHOSPHOTUNGSTATE PRECIPITATION METHOD OF ANALYSIS OF RADIOACTIVE CESIUM IN SOLUTIONS OF LONG LIVED FISSION PRODUCT ACTIVITIES. E. Mizzan. July 16, 1954. 14p. (PDB-128)

A very rapid and simple procedure is presented for the determination of cesium activity in an aqueous solution of the long-lived fission-product activities. The procedure consists of the precipitation of Cs as the phosphotungstate from a 5N HNO_3 solution by the addition of phosphotungstic acid. The precipitate is washed twice with 5N HNO_3, dried, and counted. Since the Cs recovery is complete, no radiochemical yield determination is necessary. Self-absorption and self-scattering effects in counting are made to cancel each other by choosing the right amount of Cs carrier. Good decontamination from the other long-lived fission-product activities and high radiochemical purity are obtained. The method gives a maximum deviation from the average results of less than ± 4%. (auth)

880

Geological Survey
THE PHOTOMETRIC DETERMINATION OF ALUMINUM IN PHOSPHATE MATERIALS WITH FERRON. Maryse Delevaux, Roberta Smith, and F. S. Grimaldi. Aug. 1954. 19p. (TEI-450)

The ferron colorimetric method for aluminum is applied to the analysis of aluminum in phosphatic materials such as in the aluminum phosphate (leached) zone of the Florida phosphate deposits. In these deposits the major constituents are quartz, clay, and phosphate; the aluminum content varies from 2 to 30 percent Al_2O_3; and the phosphate content varies from about 1 to 35 percent P_2O_5. The ferron reaction was found to be exceptionally sensitive to small changes in pH of solutions under the usual conditions of this determination. The conditions were modified to make the reactions independent of pH in the region of 5 to 5.6. The method was purposely designed for routine use where maximum speed is the primary consideration. Although the accuracy of the method can be improved with very slight changes in operational detail, one may expect results to be within ± 3 percent of the total aluminum content of the sample. (auth)

881

Geological Survey
RETENTION OF URANIUM DURING OXIDATIVE ASHING OF SELECTED NATURALLY OCCURRING CARBONACEOUS SUBSTANCES. Frank Cuttitta and Edward Brittin. Sept. 1954. 8p. (TEI-461)

Data are presented to show that no appreciable loss of uranium occurs when uranium-bearing carbonaceous materials undergo oxidative ashing under routine conditions and with routine care. (auth)

882

TITRATIONS IN NON-AQUEOUS SOLUTIONS. [PART] 10. NEUTRALIZATION TITRATIONS IN ANHYDROUS PYRIDINE. Oldřich Tomiček and Svatoplux Křepelka. Translated from Chem. Listy 47, 526-30(1953). 6p. Available from Associated Technical Services (Trans. 33F4C), East Orange, N. J. (AEC-tr-1981)

The possibilities of acid-base titrations in anhydrous pyridine were studied, and the acidity relations in this protophilic medium were investigated by measuring the potentials of a hydrogen electrode in solutions of formic and perchloric acids and piperidine and diethanolamine. On the basis of an evaluation of the resulting measured potentials, a scale of exponents $pH_{H_2O}^{Py}$ and pH_{Py}^{Py} was proposed. By means of standard solutions of piperidine, diethanolamine, and ammonia in pyridine, titrations of perchloric, formic, and benzoic acids, and of a "Zeokarb" ion exchanger (cationite) were carried out, either potentiometrically (preferably with a suitable glass electrode) or visually with bromothymol blue as the indicator. (auth)

883

POLAROGRAPHIC DETERMINATION OF MINUTE
QUANTITIES OF THORIUM. K. Komarek. Translated
from Sbornik Mezinarod. Polarog. Sjezou Praze, 1st
Congr. 1951, Pt. 1. Proc. 1, 611-18(1951). 5p.
(AEC-tr-1985)

884

ON THE USE OF ION EXCHANGERS FOR THE DETERMI-
NATION OF TRACE IMPURITIES IN URANIUM. Ivan G.
Draganic, Zorica D. Draganic, and Zdenko I. Dizdar (In-
stitut de Sciences Nucleaires, "Boris Kidrich", Belgrade).
Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 4, 37-
44(1954) June. (In French)

The possibility of using an Amberlite IR-120 ion exchange
column for concentrating and selectively separating trace
impurities in U for a quantitative determination is examined.
Elutions of U, Fe, and Cu in a 0.5 $\underline{N}$ oxalic acid medium, Cd,
Ni, Co, and Mn in a 1 $\underline{N}$ HCl medium, and rare earths with
ammonium citrate at a pH of 4 were obtained. The elements
were determined, except for Fe and Cu, by polarigraphic,
spectrometric, and colorimetric techniques. (tr-auth)

885

SPECTROGRAPHIC DETERMINATION OF YTTRIUM, LAN-
THANUM AND CERIUM. Dimitrije S. Pesic (Institute of
Nuclear Sciences "Boris Kidrich"). Bull. Inst. Nuclear
Sci. "Boris Kidrich" (Belgrade) 4, 49-53(1954) June. (In
English)

A copper-spark technique was used for the spectrochemi-
cal detection of Ce, Y, and La. The method is capable of
determining Ce from 10^{-5} to 10^{-6} gm, and Y and La from
2×10^{-7} to 2×10^{-6} gm. A table of preferred spectral iden-
tification lines for the three elements is given. (K.S.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

886

CONCERNING THE TEXTURE OF THE CRYSTALS
$\gamma - Fe_2O_3 \cdot H_2O$ APPEARING IN THE CORROSION OF
IRON. (O Teksture Kristallov $\gamma - Fe_2O_3 \cdot H_2O$,
Voznikauyshchikn Pri Korrosii Zheleza). N. A.
Snishakov. Translated by E. Rabkin from Zhur. Fiz.
Khim. 22, 953-5(1948). 7p. (TT-343; AEC-tr-1459)

887

X-RAY STUDIES OF SULFIDES OF TITANIUM, ZIRCONI-
UM, NIOBIUM, AND TANTALUM. G. Hägg and N. Schön-
berg (Univ. of Uppsala, Sweden). Arkiv Kemi 7, No. 4,
371-80(1954). (In English).

Sulfides of Ti, Zr, Nb, and Ta were prepared in two ways
and studied by means of x-ray powder photographs. Struc-
ture types, unit cell dimensions, and interatomic distances
for several monosulfide and disulfide phases are given.
(M.P.G.)

DEUTERIUM AND DEUTERIUM COMPOUNDS

888

VIBRATIONAL SPECTRA OF MOLECULES AND COMPLEX
IONS IN CRYSTALS. VII. THE RAMAN SPECTRUM OF
CRYSTALLINE AMMONIA AND 3-DEUTERO-AMMONIA.
F. P. Reding and D. F. Hornig (Brown Univ., Providence,
R. I.). J. Chem. Phys. 22, 1926-8(1954) Nov.

The Raman spectra of crystalline NH_3 and ND_3 were
measured at $-82°C$, using Hg 2536.5A exciting radiation.
The fundamentals ν_1, ν_2, and ν_3 were observed, but ν_4 was

not. ν_2 was split into two components by intermolecular
coupling. Lattice frequencies of both translational and
rotational origin were observed, and there was evidence of
very little coupling between them. (auth)

889

THERMAL CONDUCTIVITY OF CONDENSED GASES. III.
THE THERMAL CONDUCTIVITY OF LIQUID DEUTERIUM
FROM 19 TO 26°K. Robert W. Powers, Robert W. Mattox,
and Herrick L. Johnston (Ohio State Univ., Columbus). J.
Am. Chem. Soc. 76, 5974(1954) Dec. 5.

The thermal conductivities of liquid normal and liquid
orthodeuterium measured over the temperature interval 19
to 26°K were found to be the same within the limits of ex-
perimental error and can be expressed by the equation
$K = (2.020 + 0.04965T) \times 10^{-4}$, cal cm^{-1} sec^{-1} deg^{-1}. The
conductivity of liquid deuterium was found to be about 6%
greater than that of liquid hydrogen. (auth)

FLUORINE AND FLUORINE COMPOUNDS

890

Duke Univ.
FUNDAMENTAL RESEARCH IN ORGANIC FLUORINE
CHEMISTRY. TERMINAL REPORT [FOR THE PERIOD
SEPTEMBER 1, 1951 TO AUGUST 31, 1954]. Lucius A.
Bigelow. 20p. Contract DA-36-034-ORD-295RD. (NP-
5441)

The design and performance of a jet fluorination reactor
using undiluted F_2 are briefly discussed. The fluorination of
ethane took place as a stable pale blue glow without flame
fronts. The ethane was converted to hexafluoroethane. The
direct fluorinations of dimethyl formamide, methyl-,
dimethyl-, and trimethylamine, propionitrile, ethyl isocya-
nide, ethylenimine, and hexafluoroazomethane are discussed
and results given. (cf. NP-5262.) (J.A.G.)

891

THE ACTION OF FLUORINE ON ANODIC PROCESSES IN
ELECTROLYSIS THROUGH ZINC. (L'Azione Del Fluoro
Sui Processi Anodici Nella Elettrolisi Per Zinco). Livio
Cambi and Eugenio Bertdrelle. Translated by M. Talbot
from Chimica e industria Milan 35, 397-402(1953). 18p.
(AEC-tr-1982)

The action of F in the electrolytic deposition of Zn was
studied. Sulfuric electrolytes were used. It was found that
the presence of F increased anodic voltage and polarization,
decreased the amount of O liberated for a given current,
and increased the amount of PbO_2 and MnO_2 formed.
Chlorine in perchloric form counteracts the effects of F.
(M.P.G.)

892

THE CHEMISTRY OF REACTIONS IN BROMINE
TRIFLUORIDE. V. Gutmann. Translated by D. J.
Wright from Angew. Chem. 62, 312-15(1950). 20p.
(TT-221)

Bromine trifluoride is an effective fluorinating agent.
Almost without exception fluorides only are stable in its
solutions. Its properties as an ionizing solvent and the
analogy with other waterlike solvents are described. New
possibilities exist in preparative organic chemistry
through the formation of complex fluorides as a result of
fluorination or neutralization reactions. (auth)

893

RECENT CHEMISTRY OF FLUORINE. ORGANOMETALLIC
AND ORGANOMETALLOID COMPOUNDS OF FLUORINE.

R. N. Haszeldine (Univ. of Cambridge, England). Angew. Chem. 66, 693–701(1954) Nov. (In German)

Methods for the preparation of perfluoroalkyl iodides and their conversion to organometallic and organometalloid compounds are described. Also discussed is the chemistry of compounds, as derived from Hg, P, As, Sb, S, Se, O, N, Se, Mg, Li, and Si, whereby their use for the preparation of inorganic acids and organic compounds is especially emphasized. Finally, a description is given of examinations of the hydrolysis and the stability of fluoroalkyl compounds. Research results of the last 15 years show that a new field of chemistry defined in itself has been opened, whose scientific and industrial development promises success. (auth)

894

PHYSICAL–CHEMICAL PROPERTIES OF FLUORINE. E. Wicke and E. U. Franck (Univ. of Göttingen, Germany). Angew. Chem. 66, 701–10(1954) Nov. (In German)

A review is offered of the physical–chemical properties of fluorine according to recent determinations. Here are especially discussed the dissociation energy of the molecules and their diameter and polarizability, as well as the electron affinity and electron negativity of the fluorine atoms. In addition, a summary is offered of the values of thermic and caloric properties of fluorine in a solid, liquid, and gaseous state. The viscosity, thermal conductivity, and rate of dissociation of fluorine gas, as well as the causes of the extraordinary chemical aggressiveness of fluorine are finally discussed. (auth)

895

RAMAN AND INFRARED SPECTRA OF CF_3Br, AND CF_3I. Walter F. Edgell and Charles E. May (Purdue Univ., Lafayette, Ind.). J. Chem. Phys. 22, 1808–13(1954) Nov.

The Raman spectra of CF_3Br and CF_3I have been obtained at −100 and −40°C, respectively. The infrared spectra of both compounds have been obtained at 30°C, and some measurements have been made at 160°C. The observed frequencies were assigned to the fundamental modes of vibration, their combinations and differences. The frequencies were interpreted in correlation with other CF_3X molecules in terms of the pertinent "natural" frequencies of vibration. (auth)

896

AN INFRARED BAND OF A MOLECULAR COMPLEX BETWEEN HYDROGEN FLUORIDE AND CHLORINE TRIFLUORIDE. J. Paul Pemsler (Goodyear Atomic Corp., Portsmouth, Ohio) and D. F. Smith (Carbide and Carbon Chemicals Co., Oak Ridge, Tenn.). J. Chem. Phys. 22, 1834–6(1954) Nov.

A band at 2.57μ wavelength has an absorbance which depends upon the produce of the partial pressure of hydrogen fluoride and chlorine trifluoride and is hence attributable to a molecular complex $HF \cdot ClF_3$. This complex is present only in low concentration. The temperature variation per unit product of the pressures indicates a heat of reaction of 3.9 kcal per mole for the reaction $HF + ClF_3 \rightleftharpoons HF \cdot ClF_3$. The band is a hydrogen–fluorine stretching vibration. The complex probably does not contain a hydrogen bond. (auth)

897

INFRARED SPECTRAL STUDIES OF BrF_3 AND BrF_5. H. M. Haendler, S. W. Bukata, and B. Millard (Univ. of New Hampshire, Durham) and E. I. Goodman and J. Littman (Brookhaven National Lab., Upton, N. Y.). J. Chem. Phys. 22, 1939(1954) Nov.

Measurements of the infrared spectra of liquid BrF_3 and

BrF_5 from 2.5 to 9.5μ are reported. Infrared bands of 1337, 1250, and 1154 cm^{-1} for BrF_3 and 1355, 1298, and 1187 cm^{-1} for BrF_5 were found. A band of variable intensity occurred at about 3450 $cm^{-1}(2.9\mu)$ in calculated absorptivities agreed with measurements at all frequencies except 3450 cm^{-1}. Exposure of BrF_3 to HF vapor gave a greatly enhanced 3450 cm^{-1}, varying in intensity with different exposures to HF. (J.A.G.)

LABORATORIES AND EQUIPMENT

Carbide and Carbon Chemicals Co. (K-25) PORTSMOUTH TECHNICAL SERVICES BUILDING: AN INDUSTRIAL ATOMIC LABORATORY. Richard W. Ulm, Walter J. Hamer, Lewis H. Rogers, and Gene P. Rutledge. Nov. 29, 1954. 21p. Contract W-7405-eng-26. (K-1148)

The Portsmouth Technical Services Building was designed in order to provide the Atomic Energy Commission's Portsmouth gaseous diffusion plant with control and development laboratory facilities. Flexibility of design of the building is demonstrated by service pipe corridors, movable partitions, plug-in bus duct, and future expansion provisions. An economical building has been obtained while meeting special operational requirements. (auth)

RADIATION CHEMISTRY

Joint Establishment for Nuclear Energy Research (Norway) CHEMICAL DOSIMETRY OF RADIATIONS GIVING DIFFERENT ION DENSITIES. AN EXPERIMENTAL DETERMINATION OF G VALUES FOR Fe^{2+} OXIDATION. L. Ehrenberg and E. Saeland. 1954. 25p. (JENER-Pub.-8)

The oxidation of air-equilibrated $FeSO_4$ in dilute H_2SO_4 by x rays and by particle radiations resulting from the interaction of pile neutrons with different elements added to the solution was examined. The following G values (Fe^{3+}/100 ev) were obtained: U^{235} fission fragments, 3.0 ± 0.9; $B^{10}(n,\alpha)Li^7$, 4.0 ± 0.4; $N^{14}(n,p)C^{14}$, 7 ± 1; $Li^6(n,\alpha)T$, 5.4 ± 0.3, from which 6.5 ± 0.7 is calculated for the triton; 175-kv x rays, 17.4 ± 0.8. Since for 160-Mev protons G is found equal to (16.5 ± 1) (Fe^{3+}/100 ev), it is concluded that G is a function only of the ion density (linear energy transfer), not of other properties of the ionizing particle, and that once this function is known the reaction can be used for the dosimetry of all radiations including fast neutrons. An ion-chamber determination of the latter agrees well with the actinometric dose. Since G_{Fe}/G_{Ce} is found to vary within a wide range of ion densities a simultaneous application of ferrous and ceric sulphate dose meters can be used for an estimation of the average ion density of a poly-energetic radiation. The G values of the particles emanating from boron and lithium are found independent of the pile position and of the background intensity. Since, further, dG/dT of densely ionizing radiations (represented by fast neutrons) is found to be zero, it is proved that under the actual conditions the effects due to densely and sparsely ionizing radiations applied simultaneously are additive. Fe^{3+} was determined photometrically at 465 $m\mu$ as thiocyanate complex. When 0.7 ml 3N KSCN are added to 3 ml Fe solution, optimum conditions of sensitivity (molar extinction 8500), stability, and temperature dependence are obtained. (auth)

900

CHEMICAL FORMS ASSUMED BY C^{14} PRODUCED BY PILE NEUTRON IRRADIATION OF AMMONIUM BROMIDE: TARGET DISSOLVED IN WATER. Peter E. Yankwich and J. D. Vaughan (Univ. of Illinois, Urbana). J. Am. Chem. Soc. 76, 5851-3(1954) Nov. 20.

Chemical fractionations have been made of the radiocarbon activities produced when pile neutron-irradiated ammonium bromide crystals are dissolved in water. Methylamine is formed in greatest amount (80% of the total activity); other radio compounds found are methane (7.5%), formaldehyde (6%), cyanide (2%), and methyl bromide, carbon dioxide, carbon monoxide, formic acid, methanol and urea (each less than 2%). The paths leading from possible crystal-stabilized conglomerates to final post-solution products are explored. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

901

Oak Ridge National Lab.
DISTRIBUTION OF RARE-EARTH NITRATES BETWEEN TRIBUTYL PHOSPHATE AND NITRIC ACID. A. C. Topp and Boyd Weaver. Oct. 15, 1954. 25p. Contract W-7405-eng-26. (ORNL-1811)

Coefficients have been determined for the distribution of samarium, gadolinium, dysprosium, and yttrium nitrates between nitric acid and tributyl phosphate at various acidities and rare-earth concentrations. The dependence of extraction on rare-earth concentration increases with acidity and with atomic number of the rare earths. (auth)

902

RAPID EXTRACTION OF PURE LANTHANUM OXIDE FROM THE EARTHS. Felix Trombe. Translated by H. B. Whetsel from Compt. rend. 225, 1156-8(1947). 3p. (AEC-tr-1987)

A treatment using only nitric acid and NH_3 gas permits the rapid extraction of the greater part of lanthanum oxide contained in the rare earths in an excellent state of purity. An explanation of the procedure is given. (J.A.G)

903

HIGHER OXIDES OF TERBIUM AND PRASEODYMIUM FROM HIGH PRESSURE MOLECULAR OXYGEN TREATMENT. Wilbur Simon and LeRoy Eyring (State Univ. of Iowa, Iowa City). J. Am. Chem. Soc. 76, 5872-4(1954) Nov. 20.

Terbium and praseodymium oxides have been treated with molecular oxygen of pressures up to 282 atmospheres at temperatures as high as 450°. The compositions of the higher oxides thus produced were determined by weight changes on reduction to the sesquioxides with H_2 and CO, and by iodometric titration. X-ray diffraction patterns were observed for some of the phases produced. It was found that when the reaction vessel was desiccated carefully all the methods of analyses were in agreement. Treatment of the lower oxides of terbium and praseodymium at 282 atmospheres oxygen pressure at 400° yielded $TbO_{1.86}$ and $PrO_{2.00}$, respectively. (auth)

904

THE PREPARATION OF SOME PROTACTINIUM COMPOUNDS AND THE METAL. Philip A. Sellers, Sherman Fried, Robert E. Elson, and W. H. Zachariasen (Argonne National Lab., Lemont, Ill.). J. Am. Chem. Soc. 76, 5935-8(1954) Dec. 5.

Protactinium metal, monoxide, dioxide, pentoxide, trihydride, tetrafluoride, tetrachloride, and oxysulfide (PaOS) have been prepared. The compounds were identified by x-ray analysis, and most of them were found to be isostructural with the analogous compounds of uranium. Other protactinium compounds have been prepared but their compositions have not been established definitely. A preliminary study of the protactinium oxide system showed compounds of compositions varying from PaO_2 to Pa_2O_5. (auth)

905

YTTRIUM CHROMIUM OXIDE, A NEW COMPOUND OF THE PEROWSKITE TYPE. John T. Looby and Lewis Katz (Univ. of Connecticut, Storrs). J. Am. Chem. Soc. 76, 6029-30 (1954) Dec. 5.

A finely divided green solid was prepared from the oxides Cr_2O_3 and Y_2O_3. Inspection of the x-ray-diffraction pattern suggested that the structure was similar to that of perowskite. (L.T.W.)

SEPARATION PROCEDURES

906

Atomic Energy Research Establishment, Harwell, Berks (England)
THE SOLVENT EXTRACTION OF PRASEODYMIUM AND NEODYMIUM. J. G. Cuninghame, P. Scargill, and H. H. Willis. Aug. 13, 1954. 11p. (AERE-C/M-215)

The solvent extraction separation of praseodymium and neodymium into TBP and into a mixture of TBP and TTA in kerosene was investigated at low rare earth concentration. Maximum separation factors of 2.5 to 3 were obtained, and it is concluded that the method will have no advantages over ion-exchange separation under the imposed conditions. The TBP/TTA mixture has been shown to be an extremely powerful extracting solvent for rare earths. (auth)

907

TANTALUM AND NIOBIUM SEPARATION BY LIQUID EXTRACTION. HYDROCHLORIC ACID EXTRACTION FROM MIXED KETONES. Joseph R. Werning and Kenneth B. Higbie (U. S. Bureau of Mines, Albany, Oreg.). Ind. Eng. Chem. 46, 2491-4(1954) Dec. (cf. NSA 8-3705)

Preliminary investigations indicate that tantalum and niobium may be separated by the use of concentrated hydrochloric acid for the preferential extraction of tantalum from an aliphatic ketone solution (approximately 70% diisobutyl ketone and 30% methyl isobutyl ketone) containing mixed anhydrous tantalum and niobium pentachlorides. The data indicate that the efficiency of the separation is enhanced materially by the presence of large amounts of ferric chloride in the initial solution—the amount of tantalum extracted by the aqueous phase is increased greatly while the niobium extraction is increased only slightly. The niobium remaining in the organic phase is separated from the iron by a digestion process in the presence of controlled sulfuric acid concentrations. This process permits the efficient separation and recovery of tantalum and niobium occurring in low grade, iron-containing ores. Another valuable feature of the process is the method for the separation of iron and niobium after the extraction of tantalum. (auth)

908

ANHYDROUS SEPARATION. SELECTIVE CHLORINATION OF PARTIALLY HYDROLYZED CHLORIDES. S. L. May, A. W. Henderson, and H. A. Johansen (U. S. Bureau of Mines, Albany, Oreg.). Ind. Eng. Chem. 46, 2495-9(1954) Dec.

The economical separation of tantalum and niobium has presented a difficult problem in the past. Commercial processes suffer the disadvantages of high cost of materials and equipment. A process for anhydrous separation of tantalum and niobium, when anhydrous tantalum and niobium chlorides are treated by a process involving partial hydrolysis of the chlorides, heat treatment with ammonium chloride, and selective chlorination resulted in tantalum and niobium compounds with purities greater than 99%. By careful regulation of the extent of hydrolysis, either tantalum or niobium values may be obtained in good yield and high purity. The process is a rapid one for obtaining pure tantalum and/or niobium compounds. The method employs low cost equipment, starting materials, and reagents. (auth)

909

SEPARATION OF RADIUM FROM ITS NATURAL PRODUCTS BY PAPER CHROMATOGRAPHY. Pavle Savic and Dane N. Cvjeticanin (Institut des Science Nucleaires, "Boris Kidrich", Belgrade). Bull Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 4, 21-3(1954) June. (In French)

Successful separation of Ra was accomplished by a paper chromatographic technique using an 80% acetone, 10% HNO_3 dissolver. The radioactive elements were in nitrate form in 10 $\underline{N}$ HNO_3, and Whatman No. 4 paper was used. (K.S.)

910

A REVERSIBLE ION EXCHANGE COLUMN. Zdenko I. Dizdar (Institut de Sciences Nucleaires, "Boris Kidrich", Belgrade). Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 4, 31-5(1954) June. (In French)

The efficiency of counter-current elution in a reversible column is discussed in connection with establishing elution curves in a normal and reversed column position for Cs^+, Cu^{+2}, UO_2^{+2}, Mn^{+2}, and Eu^{+3}, using an Amberlite IR-120 ion exchange resin. (tr-auth)

911

DEVELOPMENTS IN THE CARBONATE PROCESSING OF URANIUM ORES. F. A. Forward and J. Halpern (Univ. of British Columbia, Vancouver, Canada). J. Metals 6, 1408-14(1954) Dec.

A new process for extracting uranium from ores with carbonate solutions is described. Leaching is carried out under oxygen pressure to ensure that all the uranium is converted to the soluble hexavalent state. By this method, alkaline leaching can be used successfully to treat a greater variety of ores, including pitchblende ores, than has been possible in the past. The advantages of carbonate leaching over conventional acid leaching processes are enhanced further by a new method which has been developed for recovering uranium from basic leach solutions. This is achieved by reducing the uranium to the tetravalent state with hydrogen in the presence of a suitable catalyst. A high-grade uranium oxide product is precipitated directly from the leach solutions. Vanadium oxide also can be precipitated by this method. The chemistry of the leaching and precipitation reactions are discussed, and laboratory results are presented which illustrate the applicability of the process and describe the variables affecting leaching and precipitation rates, recoveries, and reagent consumption. (auth)

912

SEPARATION OF TITANIUM, TUNGSTEN, MOLYBDENUM, AND NIOBIUM BY ANION EXCHANGE. John L. Hague, Eric D. Brown, and Harry A. Bright. J. Research Natl. Bur. Standards 53, 261-2(1954) Oct.

The results of a systematic study of the elution behavior of titanium, tungsten, molybdenum, and niobium in various hydrochloric—hydrofluoric acid media are given. These data demonstrate the behavior of the anion complexes of these elements on an anion-exchange resin column. The possibility of several interesting quantitative separations is evident, and experiments are described that demonstrate that these elements can be separated from each other. (auth)

913

SYNTHETIC ION EXCHANGE MEMBRANE DISCS. PART I. PREPARATION OF CATION EXCHANGE MEMBRANE DISCS AND THEIR PROPERTIES. N. Krishnaswamy (National Chemical Lab. of India, Poona). J. Sci. Ind. Research (India) 13, 722-6(1954) Oct.

The method of preparation of synthetic cation exchange membrane disks using the Conway unit as mould is described. Donnan diffusion studies have been carried out with samples of disks prepared and with a Saran-backed sample of Permionic CR 51. The foreign sample exhibits lower sodium chloride absorption which indicates greater screening effect and hence better perm-selective properties. (auth)

SORPTION PHENOMENA

914

Harvard Coll.
INVESTIGATION OF ION-EXCHANGE MATERIALS. J. Carrell Morris. Oct. 1954. 48p. For Chemical Corps Medical Labs., Army Chemical Center. Contract DA-18-108-CML-2940. (MLCR-43)

Results are reported from an investigation of the use of ion-exchange materials in the treatment of water supplies for the removal of toxic or hazardous substances. Cation exchange resins proved ineffectual for removal of amine or ammonium-type contaminants from water. Substantial amounts of exchange were obtained between anion exchange resins and organic arsenate and phosphate-type materials. The strongly basic anion exchange resins were found to be most effective for the removal of organic arsonates or phosphonates. Results indicate that anion selectivity is much more dependent on specific molecular structure than is cation selectivity. (C.H.)

915

BASIC STRUCTURAL TYPES OF ADSORBENTS AND THEIR EFFECT ON THE ADSORPTION PROPERTIES. A. V. Kiselev. Translated by E. Rabkin from Zhur. Fiz. Khim. 23, 452-68(1949). 40p. (TT-237; AEC-tr-979)

SPECTROSCOPY

916

Atomic Energy Project, Univ. of Rochester
A UNIVERSAL SPECTROPHOTOMETER FOR THE MEASUREMENT OF THE RELATIVE SPECTRA DISTRIBUTION OF THE CARBON ARC SOURCE. L. J. Krolak and T. P. Davis. Oct. 20, 1954. 37p. Contract W-7401-eng-49. (UR-367)

A spectrophotometer, calibrated for a useful range between 0.3 μ and 2.6 μ, was constructed to be used for determining the relative spectral energy distribution of a 24" high intensity carbon arc, and for ultimate use in reflectance and transmission studies. Several line sources and absorbing media were used to calibrate the wavelength drum scale. A tungsten ribbon filament lamp and a MacPherson

arc were used as sources of known relative spectral
energy distribution for the determination of the over-all
spectral response of the spectrophotometer. Before using
the former source, the spectral emissivities of tungsten
had to be determined for various operational temperatures.
Because of the uncertainty of results with the tungsten
ribbon filament lamp, the more reliable and simpler
MacPherson arc was finally used to determine the over-all
spectral response of the spectrophotometer. Three
different types of PbS cells and an evacuated thermocouple
were compared; it was found that the thermocouple was the
most suitable because of better noise characteristics even
though its sensitivity was lower than that of the PbS cells.
Various arrangements were devised to measure, by means
of the f/5 spectrophotometer, the intense radiation from
the f/1.6 condensing system of the 24" carbon arc source.
The resulting curve peaked at 0.500 μ, the maximum of a
blackbody at 4800°K although the short and long ends of
the carbon arc curve deviated from the ideal blackbody
curve. It was found that the relative spectral energy dis-
tribution of the 24" carbon arc is independent of the
irradiance at the exposure plane. (auth)

917

FUNDAMENTAL VIBRATIONS OF MOLECULES OF THE
TYPE OF X_2CO. Tatsuo Miyazawa. Translated from J.
Chem. Soc. Japan, Pure Chem. Sec. 74, 915-17(1953). 11p.
(AEC-tr-1983)

918

NUCLEAR MAGNETIC RESONANCE SPECTRA AND
STRUCTURE OF BOROHYDRIDE ION AND DIBORANE.
Richard A. Ogg, Jr. (Stanford Univ., Calif.). J. Chem.
Phys. 22, 1933-5(1954)

High-resolution proton magnetic resonance spectra are
presented for aqueous $NaBH_4$ and liquid B_2H_6 at 30 and 40
Mc. B^{11} magnetic resonance spectra at 6 Mc are presented
for these same substances. The details of the spectra
constitute powerful confirmation of a tetrahedral model for
BH_4^- and a bridge proton model for B_2H_6. The bridge pro-
tons in the latter display resonance at higher applied mag-
netic field than do the terminal protons, suggesting a more
hydride-ion like character for the former. Quantitative
spin-spin multiplet separations and chemical shifts are re-
corded. (auth)

919

N^{15} ISOTOPE SHIFT OF THE PERPENDICULAR BENDING
FREQUENCY IN KNO_3 AND $NaNO_3$. J. C. Decius (Oregon
State Coll., Corvallis). J. Chem. Phys. 22, 1941(1954) Nov.

Dissimilarities between the infrared absorption of KNO_3
and $NaNO_3$ in the $12-\mu$ region due to the effect of the N^{15}
isotope are discussed. (J.A.G.)

920

APPLICATION OF INFRARED SPECTROSCOPY TO THE
DETERMINATION OF IMPURITIES IN TITANIUM TETRA-
CHLORIDE. Rolf B. Johannesen, Charles L. Gordon, James
E. Stewart, and Raleigh Gilchrist. J. Research Natl. Bur.
Standards 53, 197-200(1954) Oct.

The infrared spectrum of pure titanium tetrachloride was
measured in the range of 2 to 15 microns, and, by adding
known amounts of certain substances, it was possible to
identify the common impurities likely to be found in refined
titanium tetrachloride and to establish their limits of de-
tection. The application of infrared spectroscopy made
possible a sensitive method of following the process of
purification of the tetrachloride. (auth)

SYNTHESES

921

A CELL FOR THE PREPARATION OF SMALL QUANTITIES
OF ALKALI METALS. Philip S. Baker, G. F. Wells, and
W. R. Rathkamp (Oak Ridge National Lab., Tenn.). J.
Chem. Educ. 31, 515-18(1954) Oct.

A miniature electrolytic cell is described which was de-
signed for the preparation of alkali metals from small
amounts of salts. Lithium was chosen for the developmental
work and a technique for the preparation of Li is included.
(C.H.)

TRACER APPLICATIONS

922

THE APPLICATION OF RADIOCHEMICAL TECHNIQUES
TO THE STUDY OF THE INTERACTION OF HAIR FIBERS
WITH AQUEOUS SOLUTIONS. Paul B. Stam and Howard J.
White, Jr. (Textile Research Inst., Princeton, N. J.). Tex-
tile Research J. 24, 785-91(1954) Sept.

Radioactive tracer techniques have proved to be uniquely
adaptable to the study of the interaction of hair fibers with
various aqueous solutions including dye baths. NaBr solu-
tions, NaBr—HBr solutions, NaCl solutions, and an acid dye
bath containing a sulfur-labelled acid dye for wool were
used. It was found that appreciable amounts of NaBr were
absorbed by hair from solution with a linear relationship
existing between the equilibrium amount absorbed and the
molarity of the treating solution. If acidic or basic solutions
were used, additional absorption resulting from the well-
known amphoteric properties of keratin was observed. In a
preliminary experiment, the absorption of each of three
components of an acid dye bath was followed by taking ad-
vantage of differences in radioactive behavior of the three
species. Certain rate processes have also been followed.
(auth)

TRANSURANIC ELEMENTS AND COMPOUNDS

923

THERMODYNAMICS OF THE NEPTUNIUM(IV) SULFATE
COMPLEX IONS. J. C. Sullivan and J. C. Hindman (Ar-
gonne National Lab., Lemont, Ill.). J. Am. Chem. Soc. 76,
5931-4(1954) Dec. 5.

The extraction of neptunium(IV) into benzene with the
chelating agent thenoyltrifluoroacetone has been used to
demonstrate the existence of the +4 ion of neptunium in acid
perchlorate solution. This +4 ion of neptunium has been
shown to associate with sulfate in perchloric acid solution
at an ionic strength of 2.00 according to the reactions
$Np^{+4}(aq.) + HSO_4^- = NpSO_4^{++} + H^+$, $NpSO_4^{++} + HSO_4^- =$
$Np(SO_4)_2 + H^+$. The association constants for the stepwise
reactions at 25° are $k_1 = 270 \pm 27$ and $k_2 = 11.0 \pm 2.2$. The
partial molal heat changes for the reactions are, respec-
tively, -1.17 ± 0.16 and $+3.64 \pm 1.02$ kcal/mole. The corre-
sponding partial molal entropy changes are 7.2 ± 0.6 and
18.7 ± 3.6 eu. (auth)

924

CHELATION OF THE +3 IONS OF ELEMENTS 95 THROUGH
100 WITH THENOYLTRIFLUOROACETONE. L. B. Magnus-
son and M. L. Anderson (Argonne National Lab., Lemont,
Ill.). J. Am. Chem. Soc. 76, 6207(1954) Dec. 5.

Some remarkable variations in the extraction equilibria
of the thenoyltrifluoroacetonates of the +3 actinides in tolu-
ene-aqueous systems were observed. Distribution ratios of

Eu, Yb, Ac, Am, Cm, Bk, Cf, 99, and 100 are tabulated. With the exception of element 100, the dependence of the extraction on acid concentration was measured and found to be inversely proportional to the third power of the acid concentration. These experiments give direct evidence that the stable oxidation state of the new elements Bk, Cf, and element 99 is the +3 state. (L.T.W.)

URANIUM AND URANIUM COMPOUNDS

925

Argonne National Lab.
URANIUM OXIDE PHASE EQUILIBRIUM SYSTEMS:
V, $UO_2-Nd_2O_3$; VI, U_3O_8-MgO; VII, $U_3O_8-TiO_2$. FINAL REPORT. W. A. Lambertson and M. H. Mueller. Sept. 14, 1954. 20p. Contract W-31-109-eng-38. (ANL-5312)

In a study of the $UO_2-NdO_{1.5}$ system it was found that urania will take more than 60 mole percent neodymia into solid solution. The melting point of Nd_2O_3 was found to be 2270°C ± 20°C. Two compounds of approximately the compositions $MgUO_4$ and MgU_3O_{10} were formed at 1000°C and below by reaction between U_3O_8 and MgO with some additional oxygen. At higher temperatures, an extensive solid solution phase which approaches the MgU_2O_7 composition was formed by these two oxides. No reactions were observed in the $U_3O_8-TiO_2$ compositions studied. (auth)

926

GMELIN'S HANDBOOK OF INORGANIC CHEMISTRY. SYSTEM NO. 55. URANIUM AND ITS ISOTOPES. Translated by Cyrus Feldman from p.221-79 of Gmelins Handbuch der Anorganische Chemie. System Nr. 55. Uran und Isotope mit Einem Anhang über Transurane. 8. Aufl. Verlag Chemie, Berlin, 1936. 86p. (TID-82(suppl:2))

A translation of pages 221 to 279 of the original Gmelin's Handbook on U chemistry is presented. (cf. TID 82 [Suppl 1.]). (C.H.)

927

ON THE FORM OF COMBINATION OF U IN MELTS OF SODIUM FLUORIDE. Stjepan S. Malcic (Institut fur Kernwissenschaften "Boris Kidritsch"). Bull Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 4, 45-8(1954) June. (In German)

The combination of U with fused NaF was investigated by x-ray analysis. (K.S.)

928

PHOTOSTATIONARY STATE KINETICS. Lawrence J. Heidt (Massachusetts Inst. of Tech., Cambridge). J. Am. Chem. Soc. 76, 5962-8(1954) Dec. 5.

Photoactivated uranyl ions reacting in water with methanol have been discovered to produce an intermediate U(V) species whose disproportionation into U(IV) and U(VI) gives rise to an after effect from which the concentration and rate of decay of the intermediate species has been determined. The steady-state concentration of the intermediate species and the build-up to the steady-state value have been measured as a function of the duration and extent of the photochemical reaction, the light intensity, and the temperature. The results confirm the theory of the steady state. The thermal disproportionation of the U(V) has been found to have an activation energy of 17.3 kcal in perchlorate solution at pH 1 and an ionic strength of unity. The entropy of formation of the critical complex in the same solution at 25° is +8.3 eu and △F equals 14.2 kcal. (auth)

WASTE DISPOSAL

929

ULTIMATE DISPOSAL OF RADIOACTIVE WASTES. W. S. Ginell, J. J. Martin, and L. P. Hatch (Brookhaven National Lab., Upton N. Y.). Nucleonics 12, No. 12, 14-18(1954) Dec.

A process for storing radioactive wastes is proposed employing the selective adsorption of fission-product cations on montmorillonite clay. The radioactive ions can then be sealed within the crystal lattice by heating to 1,000°C. (L.T.W.)

ENGINEERING

930

Argonne National Lab.
DEVELOPMENT AND OPERATION OF A HIGH TEMPERATURE QUENCHING FURNACE. George B. Eyerly, Wingate A. Lambertson, and Joseph H. Handwerk. Apr. 1952. 15p. Contract W-31-109-eng-38. (ANL-4863)

The development and construction of a vacuum quenching furnace for operation at temperatures up to 2800°C are described. In operation this furnace can be heated to this temperature in a period of one hour. Heated samples can be quenched in from one to three seconds, and the furnace can be cooled sufficiently to permit the removal of the specimens in thirty minutes. (auth.)

931

Ames Lab.
AN ELECTRO-MAGNETIC PUMP AND HEATING TRANSFORMER FOR HIGH TEMPERATURE LIQUID METALS. G. R. Winders and R. W. Fisher. Dec. 6, 1954. 14p. Contract W-7405-eng-82. (ISC-547)

Details of a linear electromagnetic induction pump and heating transformer for circulating Mg−Th alloy at 1000°C are given. (auth)

932

Air Cleaning Lab., Harvard Univ. School of Public Health
HOOD SCRUBBER UNIT FOR PERCHLORIC ACID. Leslie Silverman and Melvin W. First. Nov. 30, 1954. 40p. Contract AT(30-1)841. (NYO-1589)

A self-contained unit for collecting and disposing of chemical fumes, mists, and gases has been developed and field tested. It is portable and compact and when assembled, only requires connection to an electrical receptacle and water tap to be completely operational. Although originally designed at the request of Argonne National Lab. for use in conventional chemical laboratory hoods for safe disposal of perchloric acid fumes arising from acid digestions, it may be used as a substitute for a permanent hood in a variety of locations and for the disposal of diverse chemical fumes. The air cleaning system most useful for collecting acid mists was found to be a wetted glass-fiber filter followed by a glass fiber droplet eliminator plus a dry, pleated, high-efficiency glass or glass asbestos paper filter. For scrubbing gases such as NH_3 or HCl, the final dry filter can be eliminated entirely while for organic solvent vapors the wet and dry filters can be replaced by a charge of activated charcoal, silica gel, or other appropriate absorbent. Collection and disposal of the acid at the source of emission was the guiding design principle. (auth)

933

BOUNDARY-VALUE PROBLEMS OF THIN-WALLED CIR-
CULAR CYLINDER. N. J. Hoff (Polytechnic Inst. of
Brooklyn, N. Y.). J. Appl. Mechanics 21, 343-50(1954) Dec.

The homogeneous differential equations of Donnell's
theory of thin cylindrical shells are integrated. Expressions
are obtained in closed form for the displacements, mem-
brane stresses, moments, and shear forces. (auth)

AEROSOLS

934

Illinois Univ.
COLLECTION OF AEROSOL PARTICLES IN THE
PRESENCE OF ELECTROSTATIC FIELDS. Herbert F.
Kraemer and H. F. Johnstone. [1954]. 44p. Contract
[AT(11-1)-276]. (AECU-2972)

A fundamental study of the deposition of particles on
stationary spherical and cylindrical obstacles from a moving
aerosol stream in the presence of electrostatic forces is of
value in predicting the performance of new types of dust re-
moval equipment. Theoretical equations were derived for
the fraction of the aerosol deposited. An electronic digital
computer, the ILLIAC, was used to solve the equations. The
deposition of homogeneous dioctyl phthalate aerosols on a
spherical collector was measured experimentally with
various combinations of charged and uncharged collectors
and aerosol particles. The experimental results agree with
those predicted by the theory within the accuracy of the
analytical methods used to measure the deposition. As a
result of the investigation, two new types of dust collection
equipment are proposed for pilot plant study. (auth)

935

Mine Safety Appliances Co.
AN INVESTIGATION OF SAMPLERS FOR THE COLLEC-
TION AND CLASSIFICATION OF RADIOACTIVE AIRBORNE
PARTICULATE MATERIALS. PROGRESS REPORT.
Apr. 9, 1954. 32p. Contract NOssr-57527, Task No. 6.
(NP-5423)

The objective of this investigation was the design, con-
struction, and testing of prototype samplers which would
collect all particles in a dust cloud and would separate the
particles into fractions representative of those collected
in the upper and lower human respiratory tracts. This re-
port describes three samplers and gives the results of
tests made with them. In all three devices impingement was
used to collect the larger particles. In two of the samplers,
the remaining airborne particles were collected by thermal
precipitation, while filtration was used in the third. The re-
sults presented indicate that the samplers perform the de-
sired separation. Methods for using similar samplers in
determining the relative radioactivity of various size frac-
tions of dusts are suggested. (auth)

HEAT TRANSFER AND FLUID FLOW

936

California Univ., Los Angeles
STUDIES ON DENSITY TRANSIENTS IN VOLUME-HEATED
BOILING SYSTEMS. FINAL REPORT. M. L. Greenfield,
R. P. Lipkis, Chien Liu, and Novak Zuber. (Dept. of
Engineering Report 54-77). Oct. 1954. 135p. For Oak
Ridge National Laboratory Contract W-7405-eng-26,
subcontract No. 532. (AECU-2950)

The mixture density transient response of volume-heated

liquid systems subjected to a step increase in the heating
rate is studied. Experimentally, measurements have been
made by means of x-ray absorption of the density changes
in liquids subjected to time varying distributed volume heat
sources. The local liquid superheat was measured and
photographic records of the region of interest were made.
Density transient data are presented for the tested systems
at atmospheric pressure and about 135 psia. From experi-
ments the small contribution to the density change of bubbles
present during steady state boiling is deduced, thus the
importance of nucleation is shown. The effect of a bubble
initiator to increase the density response and decrease the
steady state superheat is shown. The effect of pressure is
to retard the density response. Analytically, the problem of
energy requirements and heat conduction into a growing
vapor bubble (a "moving-boundary" problem) is first
treated. Then, by considering the heat diffusion through the
liquid, the energy balance at the bubble wall and the
hydrodynamics of an incompressible, inviscid liquid, an
integro-differential equation which describes the growth of
a single bubble in a superheated liquid with uniformly dis-
tributed heat sources is formulated. An analytic solution in
closed form is presented which compares favorably with
published experimental data. A relation between the bubble
wall temperature and radius is given. Expressions for the
heat transfer coefficient and the thickness of the thermal
boundary layer are derived. Using the result of the single
bubble analysis, equations are derived which give the density
behavior of a liquid containing an ensemble of bubbles as
function of time, in terms of the steady state superheat,
power pulse, and bubble population. The theoretically pre-
dicted density transients are compared to the experimental
data. The comparison is favorable. The experimental and
analytical results show the high temperature-sensitivity of
the density transients and the importance of nucleation to
the phenomenon. (auth)

937

Atomic Energy Research Establishment, Harwell, Berks
(England)
SOME ASPECTS OF THE HIGH PRESSURE WETTED
WALL EVAPORATOR. W. Murgatroyd. Mar. 18, 1954.
27p. (AERE-X/M-124)

Pressure losses and evaporation rates have been evalu-
ated for the evaporation of water into superheated steam at
pressures up to 1500 psia. In order to do this some drastic
assumptions as to the flow conditions were necessary. It
is shown that some of these assumptions, though reasonable
in the wetted-wall columns used in the Chemical Engineer-
ing Industry, are probably invalid when working at high
pressures and high vapor velocities. A hypothesis is put
forward which, if confirmed, would simplify the complicated
two-phase flow problem at high pressures and velocities.
Experimental work is urgently needed on this problem,
since no relevant data are available for a designer.
(auth)

938

Illinois Univ.
TEMPERATURE GRADIENTS IN UNCOATED AND COATED
METAL SPECIMENS. REPORT NO. 37. Dwight G.
Bennett, W. J. Plankenhorn, and Robert G. Hicks. Apr.
1949. 21p. Contract W33-038-ac-14520(16071).
(ATI-58193)

Refractory ceramic coatings have some insulating effect
at temperatures up to 500°F. The type of coating and the

thickness to which it is applied have relatively little effect upon the temperature reductions produced by refractory ceramic coatings at temperatures in the neighborhood of 500°F. Temperature gradients in metal parts caused by the direct impingence of a natural gas-air flame may be materially reduced by refractory ceramic coatings which lower the temperature at the point of direct flame impingement and tend to raise the temperature in adjacent areas. The reduction in temperature gradients produced by refractory coatings result from the lower heat conductivity of ceramic materials as compared to metals and their greater reflective power and lower emissivity in both the visible and invisible wave bands as compared to oxidized metal surfaces. (auth)

939

Works Control Lab., Babcock and Wilcox Co.
INVESTIGATION OF EXPERIMENTAL 14″ I. D. HEAT EXCHANGER. [JOB] AEJ-4. REPORT NO. 278. R. D. Wylie and T. H. Adlon. June 29, 1953. 66p. Includes addenda: [MINUTES OF HEAT EXCHANGER MEETING HELD, FEBRUARY 24, 1953, ALLIANCE, OHIO. R. U. Blaser Babcock and Wilcox Co.]. (NP-5295)

From examination of the heat exchangers the following conclusions may be drawn: In the sections examined there was no evidence of failure of the tube attachment welds; approximately 65% of the welds showed no defects at the junction of the weld, tube, and tube sheet. The balance of the welds showed entrapped slag and minor cracks at this point; there was no evidence of tube cracking at the junction of the weld. The tubes appeared to be tightly held in the tube sheet and the grooves placed in the tube still appeared to be open. No harmful effects were noted due to the slot in the tube; there were some small cracks found in the tube sheet under the attachment welds and at the weld joining the tube sheet to the skirt. These did not appear to propagate during test, since they were only microcracks on examination; from the condition of dilution present in the root bead of the tube attachment weld it is apparent that a specially designed, higher ferrite content electrode should be used for making this weld; probably the most important conclusion would appear to be that none of the cracks found could be identified as thermal stress cracks. None of the defects such as slag pockets in the welds or small cracks appeared to propagate during the tests. Although the testing cycle was more severe than anticipated in service and the defects found did not cause leaks, it is concluded that the method of making the attachment welds here, with the resulting inherent defects, needs revision to eliminate the slag and cracking problem. (auth)

940

HEAT TRANSFER. A Symposium held at the University of Michigan during the summer of 1952. Ann Arbor, Univ. of Michigan Press, 1953. 286p.

The subjects presented at the symposium were as follows: conditions in heat transfer problems which create high thermal stress; behavior of materials under conditions of thermal stress; liquid-metal heat transfer; heat transfer with evaporation; recent developments in convective heat transfer; convective heat transfer at high velocities; transpiration and film cooling; forced convection from nonisothermal surfaces; theoretical considerations in rarefied-gas dynamics; experimental methods and results in rarefied-gas dynamics; and comparison of temperatures in solid bodies and their scaled models. (J.E.D.)

MATERIALS TESTING

941

Naval Engineering Experiment Station, Annapolis
DEVELOPMENT AND TEST OF A PERFORMANCE TEST FOR USE IN EVALUATING PENETRANT METHODS OF FLAW DETECTION. R. W. Miller. Dec. 20, 1950. 8p. (EES-6C101730; U-15991; ATI-208182)

A fixture was designed for controlling the quality of various penetrant methods of nondestructive testing. The device consists of 2 tubes butted together and held by an axial rod threaded to receive end plates and hexagonal nuts. Diagrams are presented. Evaluation tests were performed utilizing Zyglo and oil—powder methods of flaw detection. A 400 ft-lb torque on the torque wrench was sufficient to produce a synthetic defect. Inspection procedures and test results are included. (auth)

942

Hanford Works
NEW TECHNIQUES FOR LIFE-TESTING. J. L. Jaech. [Oct. 21, 1954]. 17p. Contract [W-31-109-eng-52]. (HW-34032)

Statistical factors connected with the measurement of failure rates are discussed for a group of test samples manufactured by a given process. Primary consideration is given to testing the hypothesis that standard and test units have the same failure rates. Some attention is also given to the estimation problems involved. (K.S.)

PUMPS

943

THE DESIGN OF TOTALLY ENCLOSED MECHANICAL PUMPS WITH PARTICULAR REFERENCE TO A 50 H.P. SODIUM PUMP. P. Fortescue (Atomic Energy Research Establishment, Harwell, Berks, England). J. Nuclear Energy 1, 5-23(1954) Aug.

An analysis is first made of the influence of design factors on performance of sheathed induction motors, the results being presented in the form of simple general working formulas with the case of the motor for a proposed 50-hp sodium pump worked out in detail by way of example. The general conclusion is that motors for this duty should have a large ratio of length to diameter and should work at lower magnetic loading and higher electric loading than is normal practice for unsheathed motors. The maintenance of an adequate reserve of pull out torque constitutes a major design limitation in these circumstances. With the design presented, having a 6-in. diameter motor, 25-in. long and employing a 0.03-in. thick nichrome sheath, 50 hp should be obtainable at 1,500 rpm at an over-all efficiency of 80 per cent. Increasing sheath thickness to 0.045 in. would drop efficiency by about 3 per cent. Use of a solid rotor and permitting the liquid metal to penetrate the rotor-sheath gap would involve no serious additional loss. An analysis of the problems of bearing design for use in liquid metals is then made, results being presented in the form of generalized performance charts and a discussion of their implication. The conclusion is that a vertical shaft arrangement with hydrostatic journals and a hydrodynamic thrust bearing offers great advantage. A general arrangement drawing incorporating the previously discussed recommendations in a particular design of a pump is shown. (auth)

VACUUM SYSTEMS

944

ELIMINATION OF ADSORBED WATER IN VACUUM SYS-

TEMS. M. Kent Wilson (Harvard Univ., Cambridge, Mass.). Rev. Sci. Instr. 25, 1130-1(1954) Nov.

Adsorbed moisture on the surfaces of a vacuum system can be effectively removed by filling the system with a mixture of methychlorosilane vapors and allowing the mixture to remain for a few minutes before re-evacuation. (M.P.G.)

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

945

Natural Resources Research Inst., Univ. of Wyo.
LIME BONDED AND STABILIZED WITH TITANIUM OXIDE AS A REFRACTORY FOR SPECIAL APPLICATIONS. (Final Report, Second Annual Report, Progress Report No. 8) Covering Project Period March 12, 1952-March 12, 1954. Robert L. Eichelberger. Mar. 24, 1954. 25p. Contract DA-04-200-ORD-135. (NP-5432)

Since it had previously been shown that a refractory material of CaO with the addition of 3 to 5% TiO_2 showed good resistance to phosphate melts and apparently had other desirable properties, a further study of compositions in this range was undertaken. It was found that bodies with an apparent density of 3.2 gms/cm^3 which show good resistance to hydration can be fabricated from CaO with 3 to 5% TiO_2 by pressing in a mold and firing at 1700°C. Forming pressure and green bond are not as critical as firing temperature. At temperatures below 1700°C the fired bodies are not properly matured. At higher temperature, leakage of a eutectic composition causes lowering of apparent density and slightly increased susceptibility to hydration. It is suggested that the resistance to hydration is due to a water-resistant coating of CaO−3CaO·2TiO_2 eutectic enveloping the lime grains. No thermal effects were noted in the temperature range 25 to 1000°C for CaO·TiO_2 or 3CaO·2TiO_2 using differential thermal analysis. Thermal expansion characteristics for these two compounds as well as for CaO plus 5% TiO_2 were determined. A rotary kiln lined with the lime−titania refractory was used to melt phosphate rock, with no failure of the refractory over a period of intermittent use. (auth)

946

Massachusetts Inst. of Tech.
THE MEASUREMENT OF THERMAL CONDUCTIVITY OF REFRACTORY MATERIALS. QUARTERLY PROGRESS REPORT FOR THE PERIOD ENDING OCTOBER 1, 1954. W. D. Kingery and F. H. Norton. 7p. Contract AT(30-1)-960. (NYO-6446)

Additional thermal conductivity data for refractory materials are reported, and new materials are being prepared. Equipment for determining thermal emissivity and studying radiant energy transmission is now being assembled. A furnace for preparing samples of varying crystal size and testing these for thermal conductivity and associated effects has been completed. (For preceding period see NYO-6445.) (auth)

CORROSION

947

Vita-Var Corp.
DEVELOPMENT OF A COATING, PRETREATMENT FOR METALS (WASH PRIMERS). REPORT NO. 4 [FOR] NOVEMBER 1, 1953 TO DECEMBER 31, 1953. F. Liberti and M. Shor. 85p. Contract DA-44-009-ENG-1737. (AD-28436)

Since the evidence indicates that tri-lead ortho phosphate is a good corrosion-inhibiting pigment, further evaluation has been carried on. In an effort to eliminate gellation, the tri-lead ortho phosphate was tested in combination with chromic phosphate. In another series of formulations, the phosphoric acid component of the wash primer was increased 20 and 50% over formula XP-51. A series of wash primers were formulated and tested, departing from the conventional type of resin, polyvinyl butyral, and used instead two types of vinyl acetate copolymer resins. In a further evaluation of vehicles, a modification of previous formulations has been made by replacement of part of the resin component with acrylic resin. A discussion of these formulas and results are presented. In an attempt to prevent or limit the degree of solubility of the pigment, a specially silicone treated strontium chromate has been prepared. (auth)

948

Mine Safety Appliances Co.
THE INFLUENCE OF OXYGEN ON THE CORROSION OF ARMCO IRON AND TYPE 347 STAINLESS STEEL IN 1000 F SODIUM. E. F. Batutis, S. J. Rodgers, and J. W. Mausteller. Nov. 29, 1954. 14p. Contract NObs-65426, Technical Report 33. (NP-5433)

The corrosion of Type 347 stainless steel and Armco iron was studied as a function of oxygen content in sodium in a nickel system. The corrosion rate of Armco iron varied from 0.20 mg/cm^2/month at 0.005 wt. % oxygen to 60.0 mg/cm^2/month at 0.066 wt. % oxygen. Type 347 stainless steel showed a weight gain below 0.036 wt. % oxygen and a weight loss above 0.036 wt. % oxygen; the corrosion rate varied from -1.6 mg/cm^2/month at 0.008 wt. % O_2 to +2.4 mg/cm^2/month at 0.080 wt. % O_2. (For preceding report in series see NP-5350.) (auth)

949

Purdue Univ.
INVESTIGATIONS OF THE OXIDATION OF CHROMIUM AND NICKEL−CHROMIUM STEELS. SUMMARY TECHNICAL REPORT. H. J. Yearian. June 1954. 98p. Contract N7onr-39419. (NP-5442)

The structures of the oxide scales formed on commercial chromium steels containing 5 to 26% Cr when oxidized in air or oxygen at temperatures from 700°C to 1160°C for times up to 100 hrs, have been determined by x-ray diffraction methods, assisted in some instances by chemical analysis. Two distinct types of scale are observed: A-type scale occurs when the rate of metal loss is less than approximately 10 mg/cm^2/day and B type when the attack rate is in the excessive range. For exposures near the critical conditions an initial A-type scale transforms to B type during oxidation. The essential component of A-type scale is Cr_2O_3. This is usually accompanied by α Fe_2O_3 in an amount which increases with the iron content of the alloy, i.e., with rate of attack; at high temperatures or long oxidation times, dilute solid solutions of each of these

phases in the other are formed. When the alloy contains a few-tenths percent of Mn, the A-type scale may also include copious amounts of $MnCr_2O_4$, especially for high-chrome alloys and for low-temperature oxidations in air. The structure of the scale formed on Ni–Cr steels ranging from 8 to 80% Ni and 0 to 26% Cr when oxidized for 100 hrs in air at temperatures from 1600 to 2200°F have also been investigated by x-ray diffraction. The scales are again of two types, A' and B', which are analogous to and show the same correlations with attack rate as the A and B scales, respectively, on chromium steels. (auth)

950

ALUMINUM ALLOY HEAT EXCHANGERS IN THE PROCESS INDUSTRIES. W. W. Binger and H. W. Fritts. Corrosion 10, 425-31(1954) Dec.

Aluminum heat exchanger equipment has given excellent service in ammonia dephlegmators and condensers, with natural cooling waters with pH values of 4.5 to 8.5; with steam and in petroleum catalytic and thermal cracking processes including gasoline plant service, lubricating oil service and desulfurization. Aluminum tubes also have long service records handling distilled naphthenic acids, ethyl benzene, hydrogen peroxide, fuming nitric acid, vegetable oils, oxygen, urea, and naval stores. It has proved helpful to include inhibitors in certain applications. Investigations show that the rate of heat transfer as well as the direction of heat flow sometimes are important factors determining the rate of corrosion. Details of recommended construction are included. (auth)

951

A STUDY OF CORROSION AND MASS TRANSFER OF NICKEL BY MOLTEN SODIUM HYDROXIDE. Robert A. Lad and Sidney L. Simon (Lewis Flight Propulsion Lab., Cleveland, Ohio). Corrosion 10, 435-9(1954) Dec.

The usefulness of nickel as a container material for molten sodium hydroxide is severely hampered at high temperatures by the occurrence of corrosion and mass transfer whenever a temperature gradient is present in the system. Free convection studies show that the amount of mass transfer is strongly affected by variables such as temperature level, temperature gradient, flow conditions, atmosphere, and the chemical composition of both the caustic and the nickel. It was found that normal care in the control of these variables resulted in reproducibility of the order of 200 to 300%. A test was developed which yielded results reliable to ± 10% and made it possible to study the effects of the different variables and to investigate the effectiveness of additives. The relations between mass transfer rate and temperature gradient were established in the temperature range 1400 to 1600°F. The effects of additions of a large variety of materials to the caustic were also studied. Induced flow experiments at velocities up to 15 fps were performed in an apparatus which permits independent variation of flow rate and temperature gradient. This system contained no other metal except that under study and required no pump, valves or flowmeter. A variety of additions to the caustic were made for the purpose of comparison with the free convection tests. (auth)

952

CORROSION. Mars G. Fontana. Ind. Eng. Chem. 46, 77A-80A(1954) Dec.

A brief review of the use of mechanical (scraping, brushing, scrubbing with abrasives, sand blasting, and the rubber stopper method), chemical (chemicals and solvents), and

electrolytic methods for cleaning specimens in corrosion tests is given. Specific methods for cleaning Al and Al alloys, Cu and Cu alloys, Fe and steel, stainless steels and alloys, Pb and Pb alloys, Mg and Mg alloys, Ni and Ni alloys, and Zn and Zn alloys are presented. (J.A.G.)

GEOLOGY AND MINERALOGY

953

III. POSSIBLE GEOLOGICAL SIGNIFICANCE OF BOUND BETA DECAY. IV. SEARCH FOR NEW NATURAL RADIOACTIVITIES. V. EXTINCT NATURAL RADIOACTIVITY: AN EXPERIMENTAL APPROACH. Truman P. Kohman (Carnegie Inst. of Tech., Pittsburgh, Penna.). From Proceedings of the Conference on Nuclear Processes in Geologic Settings, Williams Bay, Wisconsin, Sept. 21-23, 1953. pp.10-20. (Printed by Univ. of Chicago Press, 1954).

954

CORRELATION CHART OF URANIUM BEARING MINERALS. Colorado School of Mines Research Foundation, Inc., Golden, Colo. $5.00.

This 52 × 32 in. chart, containing over 160 uranium-bearing minerals, is divided vertically into chemical-radical columns and horizontally into chemical-element bands. Identification characteristics are given for each mineral. (auth)

955

A RECONNAISSANCE FOR URANIUM IN NEW MEXICO 1953. Roy L. Griggs (U. S. Geological Survey, Washington, D. C.). U. S. Geol. Survey Circ. 354, 1954. 9p.

In the fall of 1953 a reconnaissance for uranium was made in the Datil area of west-central New Mexico, and in the Cerrillos mining district, the Glorieta and Tecolote districts, and the Las Vegas and Colfax sill areas of north-central to northeastern New Mexico. Traces of radioactive materials were detected at many places, and deposits of uranium minerals, which may be of possible economic significance, were found near the village of Datil. Small amounts of uranium are wide-spread in sandstone beds in the Mesaverde formation. The sample of highest grade contained 0.056 percent uranium. (auth)

956

URANIUM IN THE MAYOWORTH AREA, JOHNSON COUNTY, WYOMING. A PRELIMINARY REPORT. J. D. Love (U. S. Geological Survey, Washington, D. C.). U. S. Geol. Survey Circ. 358, 1954. 8p.

The uranium mineral, metatyuyamunite, occurs in the basal limestone of the Sundance formation of Late Jurassic age along the east flank of the Bighorn Mountains, about 2 miles southwest of the abandoned Mayoworth post office. This deposit is of particular interest because it is the first occurrence of uranium mineralization reported from a marine limestone in Wyoming. (auth)

957

MEASUREMENT OF THE THORIUM AND RADIUM CONTENTS OF MINERALS WITH THE PROPORTIONAL COUNTER. Friedrich Begemann. Helv. Phys. Acta 27, 451-66(1954) Oct. (In German)

958

STUDIES OF URANIUM MINERALS. XV. SCHROECKINGERITE FROM ARGENTINA AND UTAH. Cornelius S. Hurlbut, Jr. (Harvard Univ., Cambridge, Mass.). Am. Mineralogist 39, 901-7(1954) Nov.-Dec.

Schroeckingerite crystals have been found at Moab, Utah,

and San Isidro, Argentina. They are orthorhombic pseudo-hexagonal, flattened on {001} with additional forms {010}, {110}, {014}, {012}, {011}, {021}, {041}, {118}, {114}, {112}, {111}. Unit cell dimensions are; a_0 = 9.69 A, b_0 = 16.83, c_0 = 14.26 (a_0:b_0:c_0 = 0.5758: 1: 0.8473). Space group Cmmm. Z = 4. Optically biaxial (−), X = c, Y = b. Argentina: nX = 1.492, nY = 1.543, nZ = 1.544. 2V = 10°. G = 2.550. Utah: nX = 1.490, nY = 1.537, nZ = 1.538. 2V = 18°. G = 2.544. Calculated G = 2.547. Dehydrated over H_2SO_4, schroeckingerite goes to $NaCa_3 \, UO_2(CO_3)_3SO_4F \cdot 4H_2O$ and becomes hexagonal with unit cell dimensons: a_0 = 9.72 A, c_0 = 11.03 (a:b = 1 : 1.1348). Z = 2. Optically uniaxial (−). nO = 1.581, nE = 1.532. Measured G = 2.86, calculated G = 2.874. (auth)

959

STUDIES OF URANIUM MINERALS. XVI. AN ALTERATION PRODUCT OF IANTHINITE. Judith W. Frondel and Frank Cuttitta (U. S. Geological Survey, Washington, D. C.). Am. Mineralogist 39, 1018-20(1954) Nov.-Dec.

The x-ray powder pattern of the alteration product of ianthinite is distinctive and cannot be confused with that of schoepite, which has practically the same chemical composition. Authentic x-ray powder data are lacking for ianthinite and epiianthinite. X-ray Weissenberg study, using Cu radiation, gave sharp lattice patterns. The measured specific gravity is slightly less than 3.5, and the calculated specific gravity is 3.467, assuming 8 formula units of $UO_2 \cdot 2H_2O$ per unit cell. (J.E.D.)

960

MINERALS FOR ATOMIC ENERGY. A GUIDE TO EXPLORATION FOR URANIUM, THORIUM, AND BERYLLIUM. Robert D. Nininger (U. S. Atomic Energy Commission). New York, D. Van Nostrand Company, Inc., 1954. 367p. $7.50.

The purpose of this book is to expand and complete the average interested person's knowledge of the occurrence of U and methods used in searching for it, together with similar information on Th and Be. (auth)

METALS AND METALLURGY

961

Lubrication Lab., Mass. Inst. of Tech.
THE FRICTIONAL PROPERTIES OF TITANIUM AND ITS ALLOYS. PROGRESS REPORT NO. 7 [FOR] JANUARY 1 TO FEBRUARY 28, 1954. E. Rabinowicz and E. Kingsbury. Mar. 1, 1954. 9p. Contract [NOas-54-390] (AD-28641)

962

Engineering Research Inst., Univ. of Mich.
THE INFLUENCE OF SURFACE TREATMENT ON THE FATIGUE PROPERTIES OF TITANIUM AND TITANIUM ALLOYS. PROGRESS REPORT NO. 7. L. Thomassen, M. J. Sinnott, and A. W. Demmler, Jr. Feb. 1954. 15p. Contract AF33(616)-26. (AD-28819)

The effect of surface rolling annealed V-notched specimens of Ti-75A, RC-130B, and A-110AT titanium alloys was evaluated. In all alloys a very marked increase in fatigue life, as compared to specimens given a machined notch or a ground notch, was obtained. The effect of grinding a V-notch and a square notch in Ti-75A and V-notches in RC-130B and A-110AT alloys was evaluated. The fatigue properties of the ground notches were inferior to the properties obtained on the same type of notches that were machined or rolled. (auth)

963

Laboratory of Carl A. Zapffe and Associates
GAS−METAL SYSTEMS. SEVENTH ANNUAL REPORT. [FOR] OCTOBER 1, 1952−SEPTEMBER 30, 1953. Carl A. Zapffe. 19p. Contract N6-onr-25802. (AD-28908)

A list of 90 technical reports compiled through Sept. 30, 1953 on gas-metal systems is presented. Included in the list are many translations of current Russian works on fracture and gas-metal behavior. (C.H.)

964

Smith, A. O., Corp.
FLASH WELDING ⅝" DIAMETER ROUND RC-130B TITANIUM ALLOY. J. J. Duero. Nov. 23, 1954. 12p. Contract AF-33(038)-20582. (AD-29006; AD-221)

The mechanical properties and microstructure of stress-relieved-unannealed and 1400- to 1000°F- annealed flash-welded Al−Mn−Ti alloys (RC-130B α–β alloy) are presented. The unannealed weld zone was stronger and more brittle than the parent stock. In the annealed condition, welds were more ductile and sound. Fibrous fracture surface indicated a satisfactory welding procedure. (J.A.G.)

965

Smith, A. O., Corp.
FLASH WELDING TITANIUM ALL ALPHA ALLOY A-110, .230" PLATE. J. J. Duero. Oct. 30, 1953. 10p. Contract AF-33(038)-20582. (AD-29007; AD-222)

The mechanical properties and microstructure of flash-welded Al−Ti alloys (RC-A-110 α alloy) are presented. The flash welds exhibited greater tensile strength than the parent stock and ductility sufficient to withstand 180° 3.5T radius bend or better without failure. (J.A.G)

966

Newport News Shipbuilding and Dry Dock Co.
REPORT ON THE PHYSICAL BEHAVIOR OF ZIRCALOY-2 PLATE MATERIAL PRODUCED BY THE PARK WORKS OF THE CRUCIBLE STEEL COMPANY OF AMERICA FROM INGOT NO. 7100640P72BK. L. F. Bledsoe. June 8, 1954. 25p. Contract W-7405-eng-26, Subcontract W40 X-31990. (AECU-2779)

A plate $5/16$ in. × 33.5 in. × 113 in. was produced from a 307-pound Zircaloy-2 ingot. As a result of physical tests, the plate was left in a hot-rolled condition. Additional physical tests and metallographic examinations of the material in several conditions of heat treatment and cold work were made for the purpose of evaluating the material. A comparison was made between the various properties of this material and other material supplied in different form by WAPD and ORNL. (auth)

967

Case Inst. of Tech.
AN INVESTIGATION OF SCALING OF ZIRCONIUM AT ELEVATED TEMPERATURES. QUARTERLY STATUS REPORT NO. 6 [FOR] SEPTEMBER 2 TO DECEMBER 2, 1954. W. M. Baldwin, Jr., D. J. Garibotti, and H. M. Green. Dec. 7, 1954. 8p. Contract AT(11-1)-258. (AECU-2976)

The scaling behavior of Zr in N_2 was investigated in the temperature range 800 to 1200°C. The increase in thickness with time at temperature of the scale and of the solid solution layer near the scale was determined for Zr specimens scaled in air. The hardness gradient of the metal after scaling in air was studied. (For preceding period see AECU-2928.) (auth)

968

Thomson Lab., General Electric Co.
WELDING AND METALLURGICAL CHARACTERISTICS OF
LOW CARBON, HIGH STRENGTH C.P. TITANIUM. E. F.
Hutchinson and A. J. Rosenberg. June 2, 1951. 7p.
(ATI-17112)

All three grades of commercially pure titanium which
were investigated (low-carbon high-strength RC-70,
medium-carbon high-strength RC-70, and low-carbon low-
strength Ti 75A) can be satisfactorily spot welded with an
average tensile shear strength of more than 2600 lbs over
a wide range of settings. Low-carbon RC-70 parent metal
and inert arc-welded specimen tensile strengths of over
90,000 psi are at least equivalent to those of medium-
carbon RC-70 and are 50% higher than those of Ti 75A.
Elongations of low-carbon RC-70 are somewhat higher than
those of the medium carbon grade, but much lower than
those of the higher purity Ti 75A. Welded specimen
strengths were approximately equal to parent metal
strengths, while welded specimen elongations were 20%
compared to 25% for the parent metal. The superior bends,
which were attained with the two low carbon grades, were
evident even in the parent metal. Welded specimens of
low-carbon RC-70 and Ti 75A had two or three times the
0.5T bend angle of medium-carbon RC-70. From the
combined testing of welded CP titanium, it appears that a
carbon pickup of over .25% reduces the ductility in tension
slightly and the bend ductility severely. Substitution of
small oxygen additions in place of carbon to maintain the
tensile strength of 90,000 psi was advantageous since
tensile elongations of 20% were retained in welded speci-
mens and bend ductilities were equal to those of the low-
strength Ti 75A. (auth)

969

Knolls Atomic Power Lab.
DIFFUSION OF GASES THROUGH METALS. I. DIFFUSION
OF HYDROGEN THROUGH PALLADIUM. W. D. Davis.
Oct. 1, 1954. 39p. Contract W-31-109-eng-52. (KAPL-
1227)

The maximum permeability of palladium to hydrogen was
determined in the range of 200 to 700°C for foils of differ-
ent thicknesses and pressures up to one atmosphere. The
observed permeabilities obeyed Fick's Equation for diffu-
sion of a solute within a solid. The values of D derived
from the permeability measurements can be expressed by
the equation $D = 4.3 \times 10^{-3} \exp(-5620/RT)$ cm^2/sec, where
$R = 1.986$ cal/mole/deg. The entropy of activation calcu-
lated by the method of Zener agrees with the theoretical
value of +0.55 cal/deg only if it is assumed that the dis-
solved particles occupy the tetrahedral interstitial positions
rather than the octahedral positions. (auth)

970

Minerals Research Lab., Inst. of Engineering Research,
Univ. of Calif., Berkeley
EFFECTS OF IMPURITIES AND IMPERFECTIONS ON
MECHANICAL PROPERTIES OF METALS. TECHNICAL
REPORT NO. 13. Earl R. Parker and Jack Washburn.
Nov. 1954. 31p. Contract N7-onr-29516. (NP-5443)

The substructure effect differs from the grain-size effect
in that the introduction of a substructure tends to raise the
transition temperature slightly whereas a reduction in grain
size tends to lower it. Results from simple basic experi-
ments involving dislocations arrayed in the form of small-
angle boundaries help to reveal the mechanisms of work

hardening and creep. Application of the knowledge gained
through such experiments can be applied to control or im-
prove the mechanical performance of commercial materials.
(auth)

971

Carnegie Inst. of Tech.
LATTICE IMPERFECTIONS AND GRAIN BOUNDARIES.
PROGRESS REPORT FOR JANUARY. JULY 1954. R.
Smoluchowski, C. Coleman, Y. Y. Li, W. H. Robinson,
E. W. Toor, and L. Vassamillet. Sept. 13, 1954. 5p.
Contract AT-30-1-Gen-359. (NYO-6595)

After numerous trials a satisfactory method for the
preparation of Cu–Al samples has been developed. The
furnace for growing copper bicrystals of predetermined
orientation difference has been completed and several
samples grown. The high–intensity small-angle x-ray
scattering camera which uses a bent crystal as a focussing
monochromator is in operation. Natural and proton
irradiated samples of diamond have been investigated. No
clustering of defects has been observed. A theoretical
analysis shows that surface irregularities can account for
all the observed scattering. Guinier's fine focus tube and
the sample cutter and polisher are in operation. A new
method for calculating energy of grain boundaries has been
proposed and compared with the method based on the
dislocation model. (auth)

972

Massachusetts Inst. of Tech.
SOLID SOLUTIONS AND GRAIN BOUNDARIES. PROGRESS
REPORT NO. 23. B. L. Averbach, M. Cohen, F. Herbstein,
J. Hilliard, and P. S. Rudman. Sept. 30, 1954. 5p.
Contract AT(30-1)-1002, Scope II. (NYO-7042)

The entropy and relative integral enthalpy of Al in Al-
rich, Ag-rich, and intermediate phase face-centered cubic
Al–Ag alloys were measured. A calculation of the
entropy and enthalpy of formation of face-centered cubic
Zn from hexagonal Zn was made by means of an Al–Zn
phase diagram. The quasi-chemical theory was applied to
face-centered cubic Al–Zn and Al–Ag alloys in an
attempt to correlate thermodynamic and x-ray measure-
ments. A free energy function was found which describes
the $\delta/\delta + \epsilon$ phase boundary very well up $X_{Ag} = 0.20$. X-ray
measurements of Al-rich and Ag-rich Al–Ag alloys are
discussed. (For preceding period see NYO-7041.) (J.A.G.)

973

Massachusetts Inst. of Tech.
FUNDAMENTALS OF COLD WORKING AND RE-
CRYSTALLIZATION. PROGRESS REPORT NO. 16. B. L.
Averbach, M. Cohen, S. Allen, M. F. Comerford, and C.
Houska. Sept. 30, 1954. 4p. Contract AT(30-1)-1002,
Scope III. (NYO-7072)

Progress is briefly reported on deformation of Au–Ag
alloys and brass single crystals and imperfections in
transformation products. (For preceding Period see NYO-
7071.) (J.E.D.)

974

Westinghouse Electric Corp.
JOINING OF MOLYBDENUM. W. N. Platte. Jan. 1954.
108p. Contract AF-18(600)114. (WADC-TR-54-17;
AD-29379)

By the use of a closed chamber and a continuous flow of
gas through this chamber, a controllable welding atmos-
phere was provided for experimental work. The atmos-
phere may be varied from 100% argon, 99.95% pure, to

100% O_2, N_2, or any combination of these or other gases. The chamber provides a fresh gas shield in an atmosphere of the same composition as the shield. Using the controlled atmosphere chamber, welds in carbon deoxidized arc-cast molybdenum are shown to be subject to hot short cracking when the oxygen content in the argon atmosphere around the arc exceeds 0.2%. The ductility of these welds was drastically reduced by the presence of more than 0.05% oxygen in the welding atmosphere. Oxygen in sintered molybdenum is shown to produce porosity and hot short cracking. However, crack and porosity free welds were produced by using deoxidizing agents in sintered molybdenum. (auth)

975

Armour Research Foundation
STRUCTURAL CHANGES OF COMMERCIAL TITANIUM AND TITANIUM-BASE ALLOYS ON HEAT TREATMENT. D. W. Levinson and W. Rostoker. May 1954. 121p. Contract AF 33(038)-16347. (WADC-TR-54-244)

A resistometric procedure for determination of transformation kinetics of transforming Ti alloys was developed, and results of studies on selected alloys of the systems Ti—Mn and Ti—Fe are presented. The tensile and impact properties and microstructures of three representative alloys in the system Ti—Mn, heat treated according to schedules dictated by the TTT curves established resistometrically and practical considerations, are presented. The influence of dispersed carbides, presumably TiC, on grain growth characteristics and tensile properties of three representative Ti—Mo alloys was determined. It was demonstrated that small amounts of free carbides very effectively inhibit grain growth. Further it was shown that as much as 1% C did not seriously limit the tensile properties of the heat-treated alloys. (auth)

976

Battelle Memorial Inst.
INVESTIGATIONS OF RHENIUM. C. T. Sims, C. M. Craighead, R. I. Jaffee, D. N. Gideon, E. N. Wyler, F. C. Todd, D. M. Rosenbaum, E. M. Sherwood, and I. E. Campbell. June 1954. 147p. Contract AF33(616)-232. (WADC-TR-54-371)

Methods for the preparation of fine rhenium powder from potassium perrhenate and ammonium perrhenate are discussed in detail. Consolidation of this powder by pressing and sintering into a sound massive bar is included. The metal was fabricated into rod, wire, sheet, and foil by cold-working and annealing procedures developed after hot working proved impractical. The metal was also made available in arc-melted and crystal-bar forms, and electroplating procedures were developed. Various physical, mechanical, and electronic properties were determined on the available stock. The melting point was 3180°C; the density 21.0 g/cm^3; the electrical resistivity 19 to 21 microhm-centimeters; the vapor pressure slightly more than that of tantalum; the spectral emissivity 0.36 to 0.42; and the thermal expansion 6.8×10^{-6} per cm for 0 to 1000°C. Rhenium has a Young's modulus of about 67×10^6 psi, is ductile at room temperature, and, when annealed, has a tensile strength of about 170,000 psi at room temperature. It work hardens greatly and has high elevated-temperature strength, but low ductility. Recrystallization occurs around 1300 to 1500°C. A guard-ring diode was constructed and the thermionic emission characteristics of rhenium determined; the work function is 4.80 ev and the Richardson constant 52 amp/cm^2/

K^2. Additions of thoria to rhenium did not produce enhanced emission, as with tungsten. Emission constants determined on cathodes impregnated with barium aluminate are believed to be incorrect because of poisoning. Rhenium was found to have a far greater resistance to the deleterious water cycle than tungsten. Electrical-contact tests showed that, under the test conditions, rhenium was superior to tungsten and platinum—ruthenium. The oxidation resistance is good at room temperature, but a volatile oxide forms above 600°C. Porosity appeared in rhenium filaments above 2300°C, but was eliminated when rigid impurity control was invoked. (auth)

977

Carnegie Inst. of Tech.
DAMAGE OF TITANIUM UNDER REPEATED LOAD. R. G. Crum and E. D'Appolonia. Aug. 1954. 101p. Contract DA-36-061-ORD-362. (WAL-401/68-44)

Fatigue specimens stressed above the linear-elastic range behave elastically for a part of their finite life. During the early stages of repeated loading the dynamic mid-span deflection is not plastic. Depending upon the stress level a number of cycles of repeated load must be applied before the mid-span deflection attains a value equal to the plastic deflection found under static load. When the mid-span deflection reaches this static-plastic value it increases rapidly with further load applications and damage ensues. The number of cycles of stress to produce static-plastic deflection when plotted as a function of stress is a straight line on semi-log paper. The location of this curve is to the left of the curve of failure in a manner similar to the usual fatigue damage curve. Experiments show for any stress level that the cycles of stress greater than the number of cycles of stress required to produce a dynamic mid-span deflection equal to that obtained under static load are cycles of damage. No damage, as measured by the change in the finite life of a specimen, is observed when a specimen is stressed a number of cycles of stress less than that necessary to produce a mid-span deflection found under static loading. Devices were used to record continuously for R. R. Moore-type rotating beam specimens the mid-span deflection throughout the full finite-life range and the torque necessary to turn a specimen at constant speed during cyclic stressing. These records made with specimens overstressed and understressed at different stress levels and then tested to failure, were used to establish the region of damage. Based on the experimental data, equations were developed to predict the total number of cycles to failure for various amounts of overstress and understress. The equations are expressed in nomographic chart form. The chart gives the number of cycles of stress a specimen may be expected to run for different histories of loading. Titanium (Ti—75A) was used in this study. Inferences drawn from this investigation apply to other materials. The investigation was primarily concerned with fatigue failures in the upper stress range of the S—N diagram. Tests were conducted at 30, 200, 400, 900, 1800, and 10,000 rpm with and without coolant. Effects of internal heating and strain rates on the fatigue behavior of titanium were observed. (auth)

978

Armour Research Foundation
SURFACE HARDENING OF TITANIUM WITH METALLOID ELEMENTS. INTERIM TECHNICAL REPORT [FOR] DECEMBER 1, 1953—MAY 31, 1954. A. Siede and Verne

Pulsifer. 32p. Contract DA-11-022-ORD-1319. (WAL-401/84-41)

The thorium—titanium alloy which developed exceptional surface hardness values on nitriding was examined. Metallographic examinations and depth-hardness traverses failed to establish conclusive reasons for the hardness values attained. Nitrogen concentration gradients, established by use of a Norelco geiger-counter spectrometer, were too inaccurate for use in the determination of diffusion coefficients. Dimensional changes incurred in nitrided tubular specimens of two commercial alloys indicate that besides the effect of nitrogen addition, microstructural changes incurred through prolonged heating and perhaps creep are factors affecting growth and distortion. Tests made on a large commercial retort type furnace indicate air leakage to be excessive for titanium nitriding operations. (auth)

979

THE TRANSITION METALS AND THEIR ALLOYS. W. Hume-Rothery (Inorganic Chemistry Lab., Oxford, England) and B. R. Coles (Imperial Coll. of Science and Technology, London, England). Advances Phys. 3, 149-243(1954) Apr.

980

ANNEALING OF COLD WORKED METALS. Paul A. Beck (Univ. of Illinois, Urbana). Advances Phys. 3, 245-324 (1954) June.

981

DIFFUSION OF HYDROGEN IN TITANIUM. R. J. Wasilewski and G. L. Kehl (Columbia Univ., New York). Metallurgia 50, 225-30(1954) Nov.

An investigation of hydrogen diffusion in alpha and beta titanium and observations on the reaction rates incidental to the diffusion work are described. A simplified method for the vacuum extraction analysis of hydrogen in high-purity titanium is briefly outlined. (auth)

982

BERYLLIUM AS AN ALLOYING ADDITION. L. David. Metallurgia 50, 236-8(1954) Nov.

Quite small additions of beryllium can effect appreciable changes in the properties of various alloys, so that, although it is a relatively expensive metal, its use for such purposes may represent an economy. Attention is directed to the use of beryllium in alloys of magnesium, aluminum, nickel, and copper, with particular reference to the last named. (auth)

983

KILOGRAM SCALE REDUCTIONS OF VANADIUM PENTOXIDE TO VANADIUM METAL. Arthur P. Beard and Donald D. Crooks (Knolls Atomic Power Lab., Schenectady, N. Y.). J. Electrochem. Soc. 101, 597-600(1954) Dec.

The reduction of V_2O_5 with calcium to give 750 to 1000 gram buttons of massive ductile vanadium has been accomplished. Using an iodine igniter-booster and an optimum amount of excess calcium, the authors obtained 84% yields of metal. In this process oxygen impurity seems to be the main embrittling agent, while silicon impurity up to 0.2 wt. % has no apparent effect on the vanadium. (auth)

984

INERT-GAS FORGING. Carl L. Kolbe (General Electric Co., Schenectady, N. Y.). J. Electrochem. Soc. 101, 601-3(1954) Dec.

Apparatus has been designed and operated to enable a metal specimen to remain in argon gas during an entire heating and forging operation. A furnace capable of operating to 2500°C is coupled to a 250-lb pneumatic air hammer, so that materials may be forged at extremely high temperatures with a minimum of oxidation. Molybdenum and tungsten alloys have been forged between 1750 and 2200°C without visible surface oxidation. A titanium alloy was forged at 1500°C. With this equipment there can be less diffusion of gases into the material, minor slippery oxide films, less surface cracking, easier deformation at higher forging temperatures than ever before possible. (auth)

985

DUCTILE TANTALUM BY KROLL PROCESS. H. A. Johansen and S. L. May (U. S. Bureau of Mines, Albany, Oreg.). Ind. Eng. Chem. 46, 2499-2500(1954) Dec.

The production of ductile Ta sheet on a laboratory scale from metal reduced by the Kroll Process (Mg reduction of the volatile pentachloride) is discussed. The sponge metal was arc-melted and the button was rolled to sheet. The experiments indicate that larger scale reductions like those now used to produce Ti, Zr, and Hf conceivably could permit an increased production and a lowered cost of Ta metal. (J.A.G.)

986

A LOW-ALLOY, Cr-Mo-Ti-B STEEL FOR USE UP TO 1200°F. Metal Progr. 66, No. 6, 84-9(1954) Dec.

A semi commercial heat of B-treated 3% Cr, 0.5% Mo, 0.5% Ti low-carbon steel was found to have creep and stress-rupture properties superior to stabilized 18-8, at least at temperatures up to 1200°F and times up to 100 hr. (auth)

PHYSICS

987

Los Alamos Scientific Lab.
EQUATION OF STATE OF WATER. J. M. Walsh and M. H. Rice. [1954?] Decl. Dec. 13, 1954. 8p. Contract [W-7405-eng-36]. (AECD-3639)

A plane wave high-explosive system is used to induce a shock into a 24ST Al plate. The dural plate, in turn, drives into a water specimen. Dural shock velocity, dural free surface velocity, and water shock velocity are obtained and used in a pressure-particle velocity graphical solution to completely characterize the state behind the water shock. The resulting Hugoniot curve for water is plotted along with some previous theoretical curves. (L.T.W.)

988

Argonne National Lab.
PHYSICS DIVISION QUARTERLY REPORT [FOR] MARCH AND APRIL 1954. Sept. 1954. 115p. Contract W-31-109-eng-38. (ANL-5317)

Experimental Nuclear Physics. Transmission measurements have been completed for neutron resonances in Mn at 337, 1080, and 2360 ev. Instability in the ion beam of the Van de Graaff generator has been successfully eliminated by the addition of new shield rings in the accelerator tube. Investigations of the decay schemes of Gd^{155}, Eu^{153}, Ti^{51}, Ge^{77}, and Ge^{77} are reported. Gamma spectra were obtained for Ir^{192} and Pt^{199}. The magnetic moment of the 370-kev state of Pb^{204} was measured by observation of the change in angular correlation of the 905- and 370-kev γ ray produced by an externally applied magnetic field. The result is g = +0.555 ± 0.010. Molecular beam techniques were applied for the measurement of spin and magnetic moment

of Cs^{134m}, giving $I = 8$ and $\mu = 1.1$ nm. Theoretical aspects of a technique for measuring neutron cross sections by a self-indicating method are discussed. The procedure uses a foil placed in a neutron flux, surrounded by a "filter" layer of the same foil material. The inelastic scattering of neutrons from Fe has been measured by observation of the γ rays. The REAC is being used to solve a pair of coupled non-linear equations which describe the oscillations about the circular orbit of a charged particle in a strong-focusing synchrotron. An improved gas-filled scintillation counter has been constructed with a silvered hemispherical interior coated with a plastic color shifter. A resolution of 10% was obtained at an α particle energy of 5 Mev. Mass Spectroscopy. A Ta Knudsen cell with a graphite liner was used to measure the heat of vaporization of C. It was concluded that $L_C = 170.4$ kcal. Efforts to put the argon-potassium dating method on an absolute basis have been held up by uncertainty in the branching ratio of K^{40}. Preliminary study was begun on the nature and mechanism of positive ion desorption from surfaces by high electrostatic fields. Ion yields were measured from a W tip in H_2, D_2, O_2, and C_2H_6. Theoretical Physics. Experimental and theoretical values of the total neutron cross section of Na^{23} are compared, based on an assignment of $5/2+$ for the first excited state. Some theoretical implications of spin states and the magnetic moment of Bi^{210} are discussed, together with experimental and calculated comparisons of the magnetic moments of Cl^{36}, K^{40}, and Cs^{134}. (For preceding period see ANL-5273.) (K.S.)

989

Ames Lab.

THERMAL CONDUCTIVITY OF NICKEL. Paul Oliver Davey and G. C. Danielson. June 1954. 24p. Contract W-7405-eng-82. (ISC-518)

Apparatus for measuring the thermal conductivity of metals and alloys in the temperature range from 100 to 1000°C is described. The method consists in comparing the thermal conductivity of a metal specimen to the known conductivity of Armco iron. Armco iron has been chosen as the standard since measurements by other investigators have established its conductivity within close limits. This comparison is made by measuring the axial temperature gradient in each of three cylindrical bars in series, fastened together so that the metal of unknown conductivity is between two Armco iron standards. A heater at one end of the compound bar maintains the temperature gradient. A guard tube is used to eliminate radial heat loss. The conductivities of the sample and the standard are then inversely proportional to the measured temperature gradients. Data are given on the thermal conductivity of commercial A nickel from 150 to 640°C. (auth)

990

ATOMIC HEAT OF BISMUTH BETWEEN 1° AND 4°K. P. H. Keesom and N. Pearlman (Purdue Univ., West Lafayette, Indiana). Phys. Rev. 96, 897-903(1954) Nov. 15.

Between 0.96 and 2.3°K the atomic heat of a polycrystalline ingot of bismuth (99.99 percent) can be represented by: $c = (1.213 \pm 0.006)T^3 + (0.078 \pm 0.03)T$ millijoules/mole deg. The lattice contribution, given by the cubic term, corresponds to 117°K for the low-temperature Debye θ. Between 2.3 and 4.2° K θ decreases to 105°K. The electronic contribution is much smaller than for normal metals. (auth)

991

ELECTRONIC POLARIZABILITIES OF IONS FROM THE

HARTREE-FOCK WAVE FUNCTIONS. R. M. Sternheimer (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 96, 951-68(1954) Nov. 15.

The electronic polarizability α has been calculated for several ions by obtaining the perturbation of the wave functions by an external field from a numerical solution of the differential equation satisfied by the perturbation. For the helium-like ions an analytic solution was obtained by using the wave functions of Löwdin. The calculated values of α are, in general, between 1 and 1.5 times the observed values. For several ions values have been calculated for the quadrupole polarizability which measures the quadrupole moment induced in the ion by an external charge. The effect of the dipole moment induced in the ion on the electric field at the nucleus is discussed. (auth)

992

CHARGE STATES OF HEAVY-ION BEAMS PASSING THROUGH GASES. P. M. Stier, C. F. Barnett, and G. E. Evans (Oak Ridge National Lab., Tenn.). Phys. Rev. 96, 973-82(1954) Nov. 15.

Measurements are reported of the fraction of an ion beam in the various charge states $(-1, 0, +1, +2)$ after equilibrium has been established between competing electron capture and loss reactions. The ions H^+, He^+, N^+, Ne^+, and A^+ were passed through the gases hydrogen, helium, nitrogen, oxygen, air, neon, and argon. The energy range studied was 20 to 250 kev. Under conditions of equilibrium between the singly ionized and neutral states, the velocity dependence of the charge ratios is given by $\sigma_{01}/\sigma_{10} = K_1 v^m$, where σ_{if} is the cross section for the transition between initial charge i and final charge f, v is the velocity, and K_1 and m are constants for each ion-stopping gas combination. The corresponding charge ratio for equilibrium between doubly and singly ionized states is given by $\sigma_{12}/\sigma_{21} = K_2(v - v_c)^m$, where K_2, v_c, and m are constants for each ion-stopping gas combination. The values of the constants v_c and m are tabulated. Negative ions are detectable only in the hydrogen beams. They constitute approximately 1 percent of the beam at 30 kev and decrease in number rapidly at higher energies. (auth)

993

VACUUM POLARIZATION IN MESONIC ATOMS. A. B. Mickelwait and H. C. Corben (Carnegie Inst. of Tech., Pittsburgh, Penna.). Phys. Rev. 96, 1145-7(1954) Nov. 15.

The effects of vacuum polarization on the energy levels of π and μ mesonic atoms are computed to the lowest order for states $1s(Z \le 12)$, $2p(Z \le 30)$, $3d(Z \le 82)$, $4f(Z \le 82)$. If one ignores the finite size of the nucleus, these results may be written explicitly in a closed form. The effect of the finite size of the nucleus is estimated and shown to be < 8 percent for all states considered. Since the virtual pairs are described here by plane waves, the fractional error in these results is of order $(Z\alpha)^2$. (auth)

994

CONSERVATION OF THE NUMBER OF NUCLEONS. F. Reines and C. L. Cowan, Jr. (Los Alamos Scientific Lab., New Mexico). Phys. Rev. 96, 1157-8(1954) Nov. 15.

An experiment was performed to investigate the possible decay of free protons. From the pulse-height analysis it is concluded that the lifetime of unbound protons is $> 10^{21}$ yr and the lifetime of bound protons is $> 10^{22}$ yr. The law of conservation of nucleons can, therefore, be used with confidence in discussions of nuclear reactions. (L.T.W.)

995

DIAMETER EFFECT IN CONDENSED EXPLOSIVES. THE RELATION BETWEEN VELOCITY AND RADIUS OF CURVATURE OF THE DETONATION WAVE. William W. Wood (Los Alamos Scientific Lab., N. Mex.) and John G. Kirkwood (Yale Univ., New Haven, Conn.). J. Chem. Phys. 22, 1920-4(1954) Nov.

The limiting slope of the detonation velocity-wave front curvature locus for small velocity deficits is obtained under an assumption concerning the "reaction zone length" as related to the charge diameter and the radius of curvature of the wave front. The model is an extension to two dimensions of von Neumann's classical theory of the plane wave detonation. (auth)

996

MAGNETIC BEHAVIOR OF THE SYSTEM CoO-MgO AT ELEVATED TEMPERATURES. Norman Elliott (Brookhaven National Lab., Upton, N. Y.). J. Chem. Phys. 22, 1924-5 (1954) Nov.

The magnetic susceptibilities of solid solutions of CoO and MgO have been measured at elevated temperatures. The data fit a Curie-Weiss law $\chi = C/(T + \theta)$ with $C = 3.23 \pm 0.04$, and θ varies linearly with the mole fraction of CoO. The magnetic measurements indicate that CoO has an antiferromagnetic ordering of spins of the first kind below the Curie point. (auth)

997

ON THE THEORY OF LIQUID HELIUM. I. Prigogine (Faculté des Science de l'Université de Bruxelles). Advances Phys. 3, 131-48(1954) Apr.

998

A NEW TYPE OF HIGH-VOLTAGE MACHINE. R. E. D. Clark (Cambridgeshire Technical Coll. and School of Art, Cambridge, England) and F. T. Farmer (Royal Victoria Infirmary, Newcastle upon Tyne, England). Nature 174, 1065-6(1954) Dec. 4.

The construction of a high-voltage generator, one employing a series of stationary condensers and rotating contacts and the other having stationary contacts and a series of condensers mounted on a belt are described. The performance of both types are discussed. (J.A.G.)

999

IONIZATION PROBABILITY CURVES USING AN ELECTRON SELECTOR. RESULTS ON N_2^+, N^+, Xe^{++}. E. M. Clarke (Laval Univ., Quebec, Canada). Can. J. Phys. 32, 764-74 (1954) Dec.

An apparatus consisting of an electron energy selector built into a mass spectrometer is described. With it, initial ionization yield curves may be obtained. The interpretation of these curves is discussed, and the following new measurements reported: Nitrogen: $^2\Pi_u$ state of N_2^+ at 1.0 ± 0.2 ev above initial ionization potential; $^1D^0$ state of N^+ 2.36 ev above the $^4S^0$ state; $^1P^0$ state of N^+ 1.4 ev above the $^2D^0$ state; energy of dissociation of N_2: 9.80 ev. Xenon: second ionization potential of Xe: 21.09 ev. (auth)

1000

ADVANCES IN RADIOCARBON DATING. J. Laurence Kulp (Columbia Univ. Lamont Geological Observatory, Palisades, N. Y.). Nucleonics 12, No. 12, 19-21(1954) Dec.

Correlation of the many recent advances in radiocarbon dating was achieved at a conference held in Andover, Mass., in October, 1954. The basic assumptions and problems in radiocarbon dating were summarized, counting techniques

were described, and interpretations of dating results were presented. (M.P.G.)

AEROSOLS

1001

AN IMPROVED HALIDE ION-SENSITIVE SAMPLING SURFACE FOR WATER AEROSOLS. Neil H. Farlow (U. S. Naval Radiological Defense Lab., San Francisco, Calif.). Rev. Sci. Instr. 25, 1109-11(1954) Nov.

An improved type of transparent film sampling surface is presented for 25μ to 400μ diameter water droplets which contain halide ion concentrations greater than 0.5 percent by weight. A preliminary calibration of droplet size vs film spot size has been constructed. From the calibration data an experimental estimate is made of the chloride ion sensitivity per drop size on the film. (auth)

COSMIC RADIATION

1002

CHANGES IN AMPLITUDE OF THE COSMIC-RAY 27-DAY INTENSITY VARIATION WITH SOLAR ACTIVITY. Peter Meyer and J. A. Simpson (Univ. of Chicago, Ill.). Phys. Rev. 96, 1085-8(1954) Nov. 15.

Both cosmic-ray neutron and ionization-chamber intensity observations reveal that the amplitude of the 27-day recurring intensity variation has been changing over an interval of several years. A method for studying this phenomenon using ionization chamber data for the period 1936-1946 and neutron intensity data for 1951-1953 is described which not only selects preferentially the 27-day variations but also slects the variations which are world wide. The amplitude of the 27-day intensity variation over these years displays minima and a maximum closely related in time to the minima and maxima of the approximately 11-year cycle in general solar activity. Thus, these results provide additional, and independent, evidence that solar active regions are responsible for producing the mechanism which controls the 27-day cosmic-ray primary intensity variations. (auth)

1003

LOW-ENERGY DIFFERENTIAL RANGE SPECTRUM OF COSMIC-RAY μ MESONS. A. Fafarman and M. H. Shamos (New York Univ., New York). Phys. Rev. 96, 1096-9(1954) Nov. 15.

The differential range spectrum of cosmic-ray μ mesons was investigated in the region from 0 to 410 g/cm^2 Pb for evidence of minima. Delayed coincidences in a tank of liquid scintillator were used to identify stopping mesons. The spectrum decreases monotonically with decreasing energy and shows no irregularity. Although only relative readings were taken, the method is adaptable to a precision determination of the absolute range spectrum. The delay data yield for the natural mixture of sea level cosmic-ray μ mesons a mean life in carbon of $2.13 \pm 0.07\mu$sec. (auth)

1004

COSMIC-RAY INTENSITY FLUCTUATIONS AT SEA LEVEL. Robert L. Chasson (Univ. of California, Berkeley). Phys. Rev. 96, 1116-23(1954) Nov. 15.

Geomagnetic and atmospheric influences on sea-level cosmic radiation have been studied at Berkeley, California (95-m elevation, 44° N geomagnetic latitude). The hard (20-cm lead absorber) and total intensities were measured with wide-angle triple-coincidence counter telescopes, and fluctuations of intensity were compared statistically with

changes of barometric pressure, pressure-altitude, and temperature of the lower stratosphere. The atmospheric coefficients found by Duperier were verified for the 100-millibar region, but radiosonde data were not complete enough to permit calculations for higher strata of the atmosphere. The hard and total intensity data, corrected to constant barometric pressure, were examined for fluctuations that could be correlated with geomagnetic disturbances. No apparent cosmic-ray changes accompanied any of seven geomagnetic sudden commencements. Of eighteen magnetic storm periods occurring over eight months, only four appeared definitely to be accompanied by cosmic-ray intensity decreases. No increases of intensity occurred during these periods. Of the four decreases observed, two were unusual in that the decrease occurred an appreciable time before the measurable geomagnetic disturbance (May 27 and June 25, 1951). These two events occurred during times of very great sunspot activity, but only a loose genetic relationship could be established between the sunspot behavior and the prestorm cosmic-ray decreases. (auth)

1005

DELAYED DISINTEGRATION OF A NUCLEAR FRAGMENT. A. Solheim and S. O. Sörensen (Univ. of Oslo, Norway). Phil. Mag. (7) 45, 1284-6(1954) Dec.

An event recorded in a stack of stripped Ilford G5 emulsions, each 600μ thick, exposed at high altitude is discussed. Evidence points to the event being the delayed disintegration of either a neutral or negatively charged hyperon. (L.M.T.)

1006

A CLOUD CHAMBER STUDY OF COSMIC RAY INTERACTIONS UNDERGROUND. H. J. J. Braddick and B. Leontic (Manchester Univ., England). Phil. Mag. (7) 45, 1287-92 (1954) Dec.

A multiplate cloud chamber has been used to study the interactions of cosmic rays underground. The nature of events previously reported as pairs of associated penetrating particles is discussed and an upper limiting cross section for the formation of such particles is estimated as 2×10^{-29} cm^2 per nucleon. An explanation of the high cross section found previously is put forward. A cross section of $3 \cdot 2 \pm 1 \cdot 8 \times 10^{-30}$ cm^2 per nucleon for the nuclear interaction of cosmic rays underground has been obtained. (auth)

1007

THE ALPHA-PARTICLE COMPONENT OF THE COSMIC RADIATION. C. J. Waddington (Univ. of Bristol, England). Phil. Mag. (7) 45, 1312-21(1954) Dec.

In an investigation of the primary α-particle component of the cosmic radiation a nuclear emulsion technique has been employed. A value of 60 ± 17 g/cm^2 was found for the collision mean free path of α particles in emulsion. The justification for using this value to obtain values for the mean free paths in other media is discussed. A value of 320 ± 36 α particles per m^2 per steradian per sec was found for the primary flux at a geomagnetic latitude of 55°N. This was in agreement with previous values. The energy distribution found was in agreement with that for the heavy primaries ($Z \geq 3$) given by Dainton et al. (1952) and Gottstein (1954). (auth)

1008

ON COSMIC RAYS JETS. G. Bertolino and D. Pescetti (Univ. of Turin, Italy). Nuovo cimento (9) 12, 630-8(1954) Nov. (In English)

Twenty-nine jets found in plates launched at Cagliari in the summers of 1952 and 1953 have been studied. The mean energy for mesons emitted in each jet is calculated after introduction of the anelasticity coefficient; it is inferred that the values for this energy in the low multiplicity jets are slightly greater than in high multiplicity jets. Angular distribution in the jets is studied; the results do not disagree with an isotropic distribution. (auth)

1009

LIFE TIME MEASUREMENTS OF UNSTABLE CHARGED PARTICLES OF COSMIC RADIATION USING EMULSIONS. E. Amaldi, C. Castagnoli, G. Cortini, and C. Franzinetti (Univ. of Rome, Italy). Nuovo cimento (9) 12, 668-76(1954) Nov. (In English)

Two different procedures are described which allow the determination of the mean life of charged unstable particles whose tracks are observed in nuclear emulsions. The first procedure is based on the method of "maximum likelihood." The second procedure is based on the use of the so-called "residual time." This time is defined as follows: Consider a particle with a velocity β_d at an instant t_d which decayed in flight in the plate. If it had not decayed, it would have been brought to rest in the emulsion at a time t_0. The time interval $t_d - t_0$ is the "residual time." The combination of the two methods reduces the influence of experimental bias of both geometrical and kinematical origin. The application of these methods to the case of hyperons allows one to establish the following limits to their mean life: $3 \cdot 10^{-10} \geq \tau \geq 0.5 \cdot 10^{-10}$ sec. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

1010

CRYSTAL STRUCTURE OF ZrSi AND ZrSi$_2$. H. Schachner, H. Nowotny, and H. Kudielka. Monatsh. chem. 85, 1140-53 (1954) Oct. (In German)

1011

CERIUM SULPHATE OCTOHYDRATE: OBTAINING MONO-CRYSTALS AND RADIOCRYSTALLOGRAPHIC STUDY. Jean Blandin and Claude Rérat. Compt. rend. 239, 1055-6 (1954) Oct. 27. (In French)

A procedure for preparing the monocrystals is described. An x-ray study shows that the diffracted rays belong to the overlapping group D$_{2h}^{18}$-Cmca. The edges of the crystal lattice were $a_0 = 9.91 \pm 0.01$ kx, $b_0 = 9.50 \pm 0.01$ kx, and $c_0 = 17.30 \pm 0.02$ kx. The lattice contains 4 molecules of the octohydrate. A table of lattice distances observed in the Debye-Scherrer diagram is given. (tr-auth)

1012

THEORY OF QUADRUPOLAR NUCLEAR SPIN-LATTICE RELAXATION. J. Van Kranendonk (Univ. of Amsterdam, Netherlands). Physica 20, 781-800(1954) Oct. (In English)

General theoretical expressions are derived for the nuclear spin-lattice relaxation in crystalline solids arising from the interaction of the nuclear electric quadrupole moment with the crystalline electric field. The importance of shielding, antishielding, and covalent effects for the quadrupolar spin-lattice coupling is discussed, and the complete temperature dependence of the transition probability P for a nuclear spin making a transition as a result of the thermal Raman processes is determined on the basis of some simplifying assumptions about the nature of the lattice vibrations. At low temperatures P is developed in ascending powers of the temperature T, the first term being proportional to T^7. It is found that this power series is rapidly convergent only for T smaller than about 0.02Θ, where Θ is the Debye temperature. At high temperatures, P is de-

veloped in descending powers of T, and it is found that an expression of the form $T^2(a-b/T^2)$ gives a good representation of the temperature dependence of P down to about $T = \frac{1}{2}\theta$. General expressions are derived for the dependence of the probabilities P on the direction of the external magnetic field relative to the crystal axes. Finally, a simple, one-parameter model is discussed, in which the crystalline field at a nucleus is assumed to arise from a number of equal point charges placed on the nearest neighboring lattice sites. The magnitude q of these charges is a measure for the quadrupolar spin-lattice coupling and is the adjustable parameter of the model. Detailed calculations are made with this model for crystals of the NaCl type. The calculated relaxation times $1/P$ are of the same order of magnitude as the experimental ones for values of q of the order of 10^2 to $10^3 e$, where e is the electronic charge. The significance of this result is discussed. Finally, the dependence on the direction of the external field is calculated, and the probability for a transition $\Delta m = \pm 1$ for the (111) direction is found to be about 50% larger than for the (100) direction, while the probability for a transition $\Delta m = \pm 2$ for the (111) direction is about 10% smaller than for the (100) direction. (auth)

ELECTRONS
1013

INTRODUCTION OF A FUNDAMENTAL LENGTH IN THE CLASSICAL THEORY OF THE ELECTRON. P. Caldirola and F. Duimio (Univ. of Milan, Italy). Nuovo cimento (9) 12, 699–732(1954) Nov. (In Italian)

The main difficulties connected with a classical theory of the electron interacting with the electromagnetic field are examined, especially those contained in the theories of Abraham-Lorentz and Dirac-Eliezer. Accepting the necessity of introducing a fundamental length, a finite-difference equation is proposed which is relativistically invariant. Some applications of this equation to simple problems are discussed and a general Lagrangian formulation of the theory is sketched in which the methods of Ostrogradski and of Pais-Uhlenbeck are used. (auth)

GASES
1014

NACA-TM-1113
INVESTIGATIONS OF COMPRESSION SHOCKS AND BOUNDARY LAYERS IN GASES MOVING AT HIGH SPEED. (Untersuchungen an Verdichtungsstössen and Grenzschichten in schnell bewegten Gases). J. Ackeret, F. Feldmann, and N. Rott. Translated by Mary L. Mahler from Mitteilungen aus dem Institut für Aerodynamik an Eidgenössischen Technischen Hochschule in Zürich, No. 10. Jan. 1947. 73p. (NACA-TM-1113)

1015

EVAPORATION OF A DROP IN A CURRENT OF GAS. (Ob Isparenii Kapli v Gasovom Potoke). L. S. Leibenzon. Translated by G. Belkov from Izvest. Akad. Nauk S.S.S.R. Ser. Geograf. i Geofiz. 3, 285–304(1940). 33p. (TT-489)

The present report deals with the evaporation of a spherical drop in a current of air or other gas. This refers in particular to the evaporation of a drop falling in air. On the basis of the analogy established by Nusselt between heat transfer and evaporation the solution of the stated problem is reduced to the cooling of a heated sphere by a current of gas. Approximate solutions were obtained for equations of

hydrodynamic and heat conversion, based on the theory of a boundary layer, with the method established by the author. The formulas obtained for evaporation are in satisfactory agreement with known experiments. The same refers to the formulas for heat transfer. (auth)

1016

NONMAXWELLIAN THEORY OF HOMOGENEOUS AND ANISTROPIC PLASMAS. R. Jancel and T. Kahan (Institut H. Poincare, Sorbonne, Paris, France). Nuovo cimento (9) 12, 573–612(1954) Nov. (In French)

A method for solving the integro-differential Boltzmann equation, generalizing previous results of the authors, is used to calculate the partition function of electronic velocities in an ionized anisotropic gas (subject to a constant magnetic field) for the nonmaxwellian states. This leads to explicit expressions for the magneto-ionic conductivity, the dielectric tensor, the Hall effect, the deviation of an electron beam, and the equation of motion due to Langevin. A comparison of these results is made with those obtained by other calculations based on the mean free path. The propagation of electromagnetic plane waves in such a plasma is studied. Particularly, rules are formulated for the index of refraction, the birefringence, the group and phase velocity, attenuation, wave polarization, and frequency limits. The validity of certain approximations is discussed in connection with the results of classical ionosphere theory. (tr-auth)

INSTRUMENTS
1017

Los Alamos Scientific Lab.
FIFTEEN MILLION FRAME PER SECOND CAMERA. Berlyn Brixner. [1954]. 17p. Contract [W-7405-eng-36]. (AECU-2969)

A specialized high-speed framing camera has been developed for operation up to 15,000,000 frames/sec. Use is made of a rotating mirror operating up to 23,000 revolutions/sec and 85 framing lenses working at f/26 to produce frame pictures 5×13mm in size. The speed-up is accomplished by increasing the mirror speed and the number of framing lenses per unit angle. The camera is "blind" approximately 60% of the time and hence the event to be photographed must be synchronized with the mirror rotation. (auth)

1018

Ballistic Research Labs., Aberdeen Proving Ground
A SURVEY OF MAGNETIC DRUM MEMORY SYSTEMS FOR ELECTRONIC COMPUTERS. Martin H. Weik. Aug. 1954. 18p. (BRL-Memo-819)

The results of a survey of the state of the technical art of rotating magnetic drum recording as applied to memory systems of high-speed electronic digital computers and data processing machines are presented. A brief introduction to electronic computers, memory systems, and an analysis of the survey statistics are included. (auth)

1019

European Council for Nuclear Research
APPARATUS FOR MEASURING MEAN GAP LENGTH IN NUCLEAR EMULSIONS. J. E. Hooper and M. Scharff. Apr. 11, 1954. 3p. (NP-5431)

A semi-automatic method of measuring mean gap length in emulsions has been devised for increasing speed and accuracy by eliminating the time required to write down the lengths of individual gaps. A perspex wheel with 24 evenly spaced brass contacts embedded at the perimeter is

mounted on the drum of the micrometer control of the microscope eyepiece. Contact between the wheel and a brush causes a counter or printing device to be actuated. For the particular instrument described here the interval between contacts, using a 100-power objective, corresponds to gap length of 0.12 μ. (K.S.)

1020

Naval Research Lab.
PULSE SYNTHESIS BY NETWORKS.   Donald Kirk.
Nov. 12, 1954. 20p. (NRL-4342)

Methods of pulse synthesis of electrical transient phenomena which occur during short-time intervals have been studied at NRL. Techniques have been developed to generate a number of types of pulses which are difficult to generate by the more conventional methods. Shaping of the individual steps by differentiation or integration in attenuator sections, replacing delay lines with lumped constant circuits, and use of variable attenuators and variable delay lines are a few of the modifications which may be made by those faced with the problem of making a pulser well adapted to the production of one family of pulses. The methods of addition of pulses to form complex wave fronts have been extended to the development of exponentially varying signals of definite alpha. Construction details are given for an exponential generator with an alpha from 10^7 to 2×10^9. (auth)

1021

TRIDAC (A THREE DIMENSIONAL ANALOGUE COMPUT-OR). Electronic Eng. 26, 550-1(1954) Dec.

An electronic-hydraulic computer, TRIDAC, capable of solving problems involving three dimensions has been installed at the Royal Aircraft Establishment. The operation of the computer is described. (M.P.G.)

1022

THE DESIGN AND OPERATION OF A MAGNETIC REFRIGERATOR FOR MAINTAINING TEMPERATURES BELOW 1°K. C. V. Heer, C. B. Barnes, and J. G. Daunt (Ohio State Univ., Columbus). Rev. Sci. Instr. 25, 1088-98(1954) Nov.

The problems involved in the construction of a magnetic refrigerator operating below 1°K, using superconducting metallic links for the thermal valves and a paramagnetic salt as the working substance, are discussed. A cycle for the operation of the refrigerator is suggested and then examined for the optimum operating conditions with readily available laboratory facilities. Design equations are obtained and compared with a more recent experimental model. The constructional details of a completely automatic experimental model of the magnetic refrigerator using lead for the thermal valves, iron ammonium alum as the working substance, a helium bath at 1°K as the high-temperature reservoir, a maximum magnetic field of 7000 gauss, a 2 minute cycle of operation, and capable of extracting 120 ergs/second from a reservoir at 0.3°K are presented in full. Temperatures as low as 0.2°K are obtained with this model. Improvements in this design, its use either for the production of an isothermal reservoir or as a heat sink for adiabatic demagnetization work below 1°K, and the extension to a two-engine refrigerator for the production of a reservoir at temperatures as low as 0.05°K are also discussed. (auth)

1023

AN ELECTRON INTERFEROMETER. L. Marton, J. Arol Simpson, and J. A. Suddeth (National Bureau of Standards, Washington, D. C.). Rev. Sci. Instr. 25, 1099-1104(1954) Nov. (cf. NSA 6-2982)

An interferometer of the amplitude-splitting type has been constructed which operates with electron beams and produces a system of fringes in the viewing instrument. The appearance of the fringes may be varied at will by introducing changes in one of the (electron) optical paths. The instrument utilizes crystalline diffraction for beam splitting and recombining. (auth)

1024

THE THEORY OF THE THREE-CRYSTAL ELECTRON INTERFEROMETER. J. Arol Simpson (National Bureau of Standards, Washington, D. C.). Rev. Sci. Instr. 25, 1105-9 (1954) Nov.

An elementary theory based on light optical analogues is presented. Calculations of fringe orientation are in good agreement with experimental values. The theory leads to a value, based on experimental data, of the coherence length of an electron in excess of 5800 wavelengths. (auth)

1025

A RECORDING VACUUM GAUGE. Dallas T. Hurd and M. L. Corrin (General Electric Research Lab., Schenectady, N. Y.). Rev. Sci. Instr. 25, 1126-8(1954) Nov.

The Langmuir viscosity vacuum gage has been modified to provide electrical recording of low-pressure data. A particular advantage of this type of gage is that, once calibrated, it may be used with any gas, including reactive or unstable compounds, or with gases having low condensation pressures. The gage utilizes the changing capacitance between a stationary electrode and an oscillating fiber, the rate of damping of which is a function of the composition and pressure of the ambient gas, to modulate the frequency of an oscillator. The output from the oscillator is demodulated in a discriminator circuit, amplified, and recorded. The pressure of the gas is then determined from the recorder trace. Alternatively, the signal may be used to actuate relays or servomechanisms. The fiber is set into oscillation by means of an electromagnet, so the entire operation of the device may be made automatic if desired. (auth)

1026

THE OPERATION OF PHOTOMULTIPLIER TUBES AT HIGH VOLTAGES. Robert Stump and Harry E. Talley (Univ. of Kansas, Lawrence). Rev. Sci. Instr. 25, 1132 (1954) Nov.

Breakdown of photomultiplier tubes at high voltages has been found to be due to circuit instability rather than to the tube itself. By regulating the voltages on the last two or three dynodes, a tube which would not operate above 1200 volts in the usual circuit performed satisfactorily with a cathode voltage of up to 1700 volts. (M.P.G.)

1027

IMPROVING THE LINEARITY OF PULSE AMPLIFIERS. Edward Fairstein (Oak Ridge National Lab., Tenn.). Rev. Sci. Instr. 25, 1134-5(1954) Nov.

Circuit changes are described which can be used with nearly all pulse amplifiers to improve the linearity of the voltage output. (M.P.G.)

1028

A SINGLE CRYSTAL TEMPERATURE CONTROLLED OVEN FOR AN X-RAY SPECTROMETER. R. Lefker, A. deBretteville, Jr., and J. S. Dodd (Signal Corps Engineering Labs., Fort Monmouth, N. J.). Am. Mineralogist 39, 976-82(1954) Nov.-Dec.

An oven was built to heat a single crystal on the end of a goniometer head so that absolute x-ray diffraction intensity

measurements of the basal plane reflections could be made at various temperatures. The temperature range is 50 to 270°C and the temperature stability is within ±0.1°C. This stability is accomplished by a main winding and a controlled auxiliary winding outside the circumference of the main winding; these windings radiate energy to a copper block in which the crystal is mounted, and so maintain constant crystal temperature. (auth)

ISOTOPES

1029

NATURAL ABUNDANCE OF THE LITHIUM ISOTOPES. Dwight A. Hutchison (Argonne National Lab., Lemont, Ill.). Phys. Rev. 96, 1018-21(1954) Nov. 15.

The natural abundance ratio of the lithium isotope of mass 7 to the isotope of mass 6 has been determined from the density and x-ray data for certain crystals. Consideration of the maximum limits of variation of this ratio in nature and the error assignments of the data used in this calculation have resulted in the value 11.53 ± 0.29. This value disagrees with the mass spectrometric and optical determinations. Some of the possible errors in the mass spectrometric work are considered. (auth)

1030

NOTE ON THE KINETICS OF EXCHANGE OF ISOTOPES WITH APPRECIABLE ISOTOPE EFFECT. Lars Melander (Nobel Inst. of Chemistry, Stockholm, Sweden). Arkiv Kemi 7, No. 3, 287-9(1954). (In English)

The kinetics of isotopic exchange reactions are investigated for the case of appreciable isotope effects. A knowledge of the exchange mechanism is not assumed. Conclusions that can be drawn from this investigation are discussed. (M.P.G.)

MASS SPECTROGRAPHY

1031

AN ELECTRON CURRENT AND ENERGY REGULATOR FOR MASS SPECTROMETER ION SOURCES. Dwight A. Hutchison and Jay R. Wolff (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. 25, 1083-8(1954) Nov.

An improved electron current and energy regulator for mass spectrometer ion sources is described. The improvements over previous regulator circuits consists of (a) a two-kilocycle filament excitation supply which allows improved filament emission control and (b) a method of controlling the filament to shield voltage over a wide range of electron energies. Data on isotope ratio measurements are provided to show the increased stability over that of previous regulators. (auth)

1032

SOME MASS SPECTROMETRIC DATA ON PHOSPHORUS. Larkin Kerwin (Laval Univ., Quebec, Canada). Can. J. Phys. 32, 757-8(1954) Dec.

Investigation of red phosphorus with a mass spectrometer shows the element to be monoisotopic to 1 part in 50,000. The relative abundances of the molecules resulting from electron bombardment of natural phosphorus are given, and the existence of the molecule P8 in nature is reported. (auth)

MATHEMATICS

1033

California Univ., Los Angeles
NUMERICAL ANALYSIS RESEARCH UNPUBLISHED

STATISTICAL TABLES. TECHNICAL REPORT. D. Teichroew. Dec. 8, 1954. 10p. Contracts Nonr-233(24), DA 04-495-Ord-559, and AF-18(600)-931. (NP-5440)

MEASURING INSTRUMENTS AND TECHNIQUES

1034

Atomic Energy Research Establishment, Harwell, Berks (England)
THE STATISTICAL SIGNIFICANCE OF VERY LOW COUNTING RATES. E. A. C. Crouch. July 21, 1954. 9p. (AERE-C/R-1458)

The fiducial limits for the net activity are derived for the case where the background count is of the same order as the activity and both are very low. A table of these limits is given together with illustrations of its use. (auth)

1035

Army Medical Research Lab., Fort Knox
EARLY HISTORY OF THE SCINTILLATION COUNTER, A NEW TOOL IN RADIOBIOLOGICAL RESEARCH. A. T. Krebs. Oct. 25, 1954. 17p. (AMRL-149)

The history of the scintillation counter is reviewed, after which the application of the now highly perfected, sensitive instrument to the study of weak luminescence of biologically important compounds is discussed. Phenomena associated with changes in scintillation efficiency after heavy x irradiation and the mechanism of energy transfer are briefly treated, with observations from the utilization of liquid scintillators being especially emphasized. 32 references. (L.M.T.)

1036

Ames Lab.
SCINTILLATION COUNTERS FOR SLOW NEUTRONS. John A. Dooley and Harrison Shull. Dec. 1953. 118p. Contract W-7405-eng-82. (ISC-497)

The suitability of boric oxide glass containing phosphorescent materials for use as scintillation counters for slow neutrons is investigated both theoretically and experimentally. A theory is developed which can be used for predicting counting efficiencies of the phosphor disks given optical data and neutron absorption properties of the materials present, and physical details of the experimental arrangement. This is compared to experiment in one case with good agreement. It is shown that there are serious practical difficulties in the use of a boric oxide glass phosphor as a slow neutron detector. The literature of scintillation counting is reviewed with especial attention to slow neutron counting. A bibliography of this field containing over 500 entries classified by subject matter is included. (auth)

1037

Ames Lab.
DEVICE FOR DETECTION AND IDENTIFICATION OF CHARGED PARTICLES FROM PHOTONUCLEAR REACTIONS. Albert William Snyder and D. J. Zaffarano. Dec. 1953. 35p. Contract W-7405-eng-82. (ISC-499)

A device is described which makes possible the determination of the energy spectrum of protons, alpha particles, or deuterons in the presence of other charged particles. Energy loss per unit path length (dE/dx) and total energy (E) are displayed in the form of voltage pulses of varying amplitudes in quadature on an oscilloscope screen. The peaks of the pulses are intensified, resulting in hyperbolic loci for different types of particles. By masking the

oscilloscope screen and using the moving film pulse-height analysis technique developed in this laboratory, independent energy spectra may be obtained for each type of particle. A multiple-wire type proportional counter and a scintillation counter are employed in the same gas envelope. An energy loss of 200 kev in the gas counter suffices to permit good discrimination between protons and deuterons in the energy region 0 to 20 Mev. (auth)

1038

Knolls Atomic Power Lab.
DETERMINATION OF EFFICIENCY OF KANNE CHAMBER FOR DETECTION OF RADIOGASES. J. J. Fitzgerald and B. W. Borelli. Nov. 8, 1954. 33p. Contract W-31-109-Eng-32. (KAPL-1231)

Experimental results and theoretical calculations are in good agreement for the relationship between induced currents in a 16.3-liter Kanne Chamber and the concentration of radiogases in air. The current to concentration ratio is adequately expressed by the following formula for beta particles in the maximum energy range of 0.018 to 0.695 Mev: $I = 9.57 \times 10^{-11} E/W$, where I is the current to concentration ratio in ampere/($\mu c/cc$); E is the average beta energy per disintegration, in ev/dis; and W is the average energy required to form an ion pair, in ev/ip. (auth)

1039

Naval Research Lab.
INTERIM REPORT ON THE NAVAL RESEARCH LABORATORY HIGH-CURRENT PHOTOMULTIPLIER. J. D. Shipman, M. R. McCraven, and R. V. Talbot. July 15, 1954. 13p. (NRL-4404)

The early development of a high-current photomultiplier tube designed for use as a nuclear detector has been carried on at the Naval Research Laboratory. By the use of extended electrodes and special final dynode and collector geometries it has been possible to provide sufficient output current to drive low impedance coaxial lines to the level required to drive a cathode-ray tube directly. Thus, this tube can be used to replace the previously used combination of photomultiplier and power amplifier. Prototype tubes have been built with linear output up to 2 amp. Difficulties with regeneration limited the output current to this value. Present work is directed toward the construction of a number of similar tubes having improved characteristics and it is expected that a linear output of 5 amp will be obtained. (auth)

1040

Bausch and Lomb Optical Co.
PRELIMINARY REPORT ON HIGH LEVEL DOSIMETER GLASSES. Norbert J. Kreidl. Nov. 8, 1954. 8p. Contract AT(30-1)-1312. (NYO-3781)

Cobalt, in phosphate and silicate glasses, prevents the formation of the bands developed in the base glass under gamma radiation; at the same time broad short wavelength absorption is developed. With increasing concentration of cobalt, the sensitivity is increased and room temperature fading decreased. Sensitivity in the range of 400-450 millimicrons makes glass of this type excellently suited for dose evaluation in a Bausch & Lomb Spectronic 20 Spectrophotometer-Colorimeter, which was adapted by a special holder for this dosimeter use. (auth)

1041

Tonawanda Lab., Linde Air Products Co.
INVESTIGATION OF GEIGER COUNTERS. FINAL RE-PORT. C. M. Birdsall and R. J. Wickham. Oct. 25, 1950. 41p. Contract N8 onr-70901. (U-13876; ATI-208130)

Results are reported from a study of the deterioration of halogen-quenched G-M counters and an evaluation of gas mixtures and quenching agents for use in counters. Results of the investigation led to the conclusion that halogen counters will replace other types as G-M radiation detectors. Design features of these counters include low voltage operation, simplicity of construction, high efficiency, effective operation over a wide temperature range, and a probable infinite life of the filling. (C.H.)

1042

Atomic Energy Project, Univ. of Calif., Los Angeles
INITIAL DEVELOPMENT OF A SEMI-CONDUCTOR FAST NEUTRON DOSIMETER. Benedict Cassen, Thomas Crough, and Herbert Gass. Oct. 15, 1954. 15p. Contract AT-04-1-GEN-12. (UCLA-309)

The current methods of construction and measurement of single-crystal-germanium fast-neutron dosimeters are described. The results of preliminary calibration attempts indicate that the conductivity change of these dosimeters responds linearly from 200 rep to at least 4,800 rep of cyclotron-produced neutrons having a spectrum resembling a fission spectrum. At 100 rep the conductivity decreases very slightly instead of increasing. This effect probably arises from going over the hump from slightly n-type to slightly p-type germanium. It is being tested as to whether a pre-irradiation will enable linearity to be obtained in the 100-rep range or less. In any event, a biologically interesting range of fast neutron dosages can be studied with these dosimeters, even in the presence of much larger rep dosages of gamma radiation. (auth)

1043

FLUORESCENT RESPONSE OF NaI(Tl) TO NUCLEAR RADIATIONS. F. S. Eby and W. K. Jentschke (Univ. of Illinois, Urbana). Phys. Rev. 96, 911-20(1954) Nov. 15.

The dependence on thallium concentration of the fluorescent response of NaI(Tl) to gamma rays and charged particles has been examined for crystals containing known mole fractions of Tl in the range from 0.00006 to 0.008. Scintillations were detected with a photomultiplier tube, and pulses were displayed on an oscilloscope and recorded photographically. Plots of integrated pulse height vs. energy for alpha-particle excitation show a region of nonlinearity which decreases with increasing Tl concentration. At sufficiently high alpha-particle energies a linear relation is approached for all crystals. No deviations from linearity were observed in plots of pulse height vs. energy for deuterons or protons in crystals containing a Tl mole fraction of 0.0013. The fluorescent efficiency increases sharply with Tl concentration for mole fractions smaller than about 0.0015 and decreases for higher concentrations, this behavior being more pronounced for deuteron than for alpha-particle excitation. Four separate decay processes characterize the pulse shapes. In addition to the main part of the pulse, which has a rise time (mean life) of about 5.9×10^{-8} sec and a long, concentration dependent, exponential decay (decay constant 2.3 to 3.5×10^{-7} sec, independent of exciting radiation), there are two faster decays: 1, an emission with a decay constant of 1.2×10^{-8} sec from crystals containing Tl mole fractions less than about 0.0002; and 2, a 1.5×10^{-8} sec decay from high Tl content crystals excited by particles having a large specific energy loss. The emission spectrum consists of two bands centered about 3500 and 4100 A, their

exact positions depending upon the Tl concentration and shifting toward longer wavelengths with increasing Tl concentration. The 1.2×10^{-8} sec emission is from the short wavelength band, and the other emissions are from the band at 4100 A. The dependence of the integrated pulse height on the Tl concentration and specific energy loss of the exciting particle are discussed, and possible explanations of the various decay processes are suggested. (auth)

1044

NEUTRINO RECOIL SPECTROMETER. INVESTIGATION OF A^{37}. O. Kofoed-Hansen (Univ. of Copenhagen, Denmark). Phys. Rev. 96, 1045-50(1954) Nov. 15.

A neutrino recoil spectrometer has been constructed. The recoil momentum and the charge distribution of the recoil ions from the K capture of A^{37} has been studied. The results are: neutrino energy, (812 ± 8) kev; recoils of charge 1, (26 ± 3) percent; recoils of charge 2, (13 ± 4) percent; recoils of charge 3, (38 ± 4) percent; recoils of charge 4, (18 ± 2) percent; recoils of charge 5, (4 ± 1) percent; and recoils of charge 6, (1 ± 1) percent. Furthermore, the average momentum of the electrons emitted during the ionization of the recoils is 69 ± 1 gauss-cm. The most energetic Auger electrons have a momentum of 162 ± 4 gauss-cm, and they occur in (65 ± 5) percent of the decays. (auth)

1045

SCINTILLATION COUNTER FOR MEASURING RADIATION CONTAINED IN THE AIR. A. Malvicini (Laboratori C.I.S.E., Milan, Italy). Nuovo cimento (9) 12, 821-3(1954) Nov. (In Italian)

1046

DIRECTIONAL SCINTILLATION COUNTERS OF IMPROVED SENSITIVITY. E. S. Williams (Middlesex Hospital Medical School, London, England). Brit. J. Radiol. 27, 688-91(1954) Dec.

Methods are described for increasing the sensitivity of directional γ-ray counters for use in clinical tracer work. (C.H.)

1047

RESOLUTION LOSSES IN COUNTERS AND TRIGGER CIRCUITS. Paul E. Damon and Paul N. Winters (Univ. of Arkansas, Fayetteville). Nucleonics 12, No. 12, 36-9(1954) Dec.

A theory of counting losses due to the finite resolving time of nuclear detection equipment is presented. Results of experiments with G-M counters and trigger circuits agree well with the theory. Accurate estimation of counting losses can be obtained for a G-M tube in series with a trigger circuit. (M.P.G.)

1048

AUTOMATIC REGISTRATION OF PARTICLE TRACKS IN THE CONTINUOUS DIFFUSION CLOUD CHAMBER. Branislav I. Lalović, Aleksandar B. Milojević, and Miho A. Cerineo. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 4, 97-103(1954) June. (In English)

A continuous diffusion cloud chamber has been adopted for automatic work by means of a photomultiplier tube which triggers the photographic system when particle tracks appear. Investigations were made on the working conditions of the cloud chamber with different vapors and at different temperature intervals. (M.P.G.)

1049

ON THE CONSTRUCTION OF LARGE NUCLEAR EMULSION BLOCK DETECTORS. R. R. Daniel, G. Friedmann, D. Lal,

Yash Pal, and B. Peters (Tata Institute of Fundamental Research, Bombay, India). Proc. Indian Acad. Sci. A40, 151-7(1954) Oct.

The construction of large block detectors from stacks of nuclear-emulsion sheets is discussed. Networks of α-particle active threads were used between emulsions to enable emulsion distortion to be detected and the microscope slides to be aligned with an accuracy of approximately 5μ. (M.P.G.)

1050

A RADIATION BALANCE FOR THE MICROCALORIMETRIC COMPARISON OF FOUR NATIONAL RADIUM STANDARDS. W. B. Mann. J. Research Natl. Bur. Standards 53, 277-81 (1954) Nov.

The design of a radiation balance, a twin microcalorimeter utilizing the Peltier effect, to accomodate three Hönigschmid radium standards is described. The rate of energy production of radium and its daughter products down to radium D, for unit mass of radium element in terms of all three Hönigschmid standards, was found to be equal to 138.6 cal g^{-1} hr^{-1}. (auth)

1051

CHARACTERISTICS OF AN ELECTRON MULTIPLIER IN THE DETECTION OF POSITIVE IONS. C. F. Barnett, G. E. Evans, and P. M. Stier (Oak Ridge National Lab., Tenn.). Rev. Sci. Instr. 25, 1112-15(1954) Nov.

An Allen-type electron multiplier has been studied to determine its feasibility as a quantitative detector of positive ions. Results are presented showing the gain or efficiency as a function of aging, pressure, dynode voltage, and input current. Also, the gain is presented for several positive ions (H^+, H_2^+, He^+, N^+, Ne^+, N_2^+, A^+) in the energy range from 5 to 250 kev. (auth)

1052

ON THE USE OF NUCLEAR RESEARCH EMULSIONS WITH EMBEDDED WIRES. E. G. Silver and R. W. Waniek (Harvard Univ., Cambridge, Mass.). Rev. Sci. Instr. 25, 1119-23(1954)

The importance of determining the nucleus involved in a specific interaction within a nuclear research emulsion is discussed, and the technique used to embed thin filaments in these emulsions is described in detail. The usefulness of this method is illustrated by an experiment in which nylon, molybdenum, and tungsten wires were embedded in Ilford G5 emulsion, and the plates subsequently used to study neutron induced interactions. The uncertainties encountered and the corrections introduced in this method are analyzed. (auth)

1053

EFFICIENT, FAST, ENERGY SENSITIVE γ-RAY COUNTERS FOR USE ABOVE 50 MEV. G. E. Pugh, D. H. Frisch, and R. Gomez (Massachusetts Inst. of Tech., Cambridge). Rev. Sci. Instr. 25, 1124-6(1954) Nov.

Two energy-sensitive gamma-ray counters which have been used in experiments above 50 Mev are described. One counter uses a low Z scintillating liquid to measure the energy loss of an electron pair; the other uses high Z material to develop a shower which is sampled with scintillating plastic sheets. Curves of the experimental performance are included. (auth)

1054

A THIN, WIDE-APERTURE PROPORTIONAL COUNTER. R. M. Eisberg and Harvey E. Wegner (Brookhaven National

Lab., Upton, N. Y.). Rev. Sci. Instr. 25, 1129(1954) Nov.

A proportional counter has been designed and constructed with an aperture of $2\frac{1}{2}$ in. by $2\frac{1}{2}$ in. and a thickness of $\frac{5}{8}$ in. Cylindrical counter units electrically connected in parallel are approximated by hexagonal patterns of grounded one-mil cathode wires with three-mil anode wires at the centers of the hexagons. Electron multiplication varied from 8 to 130 depending upon counter voltage. Pulse rise time was 0.20 μsec at 1700 volts. The counter appeared to be quite insensitive to gas contamination. (M.P.G.)

1055

A CLOUD CHAMBER WINDOW HOLDER. E. L. Goldwasser and V. O. Nicolai (Univ. of Illinois, Champaign). Rev. Sci. Instr. 25, 1135-6(1954) Nov.

Polyester films have been found to be desirable for thin windows in cloud chambers. The design of a holder for the windows and a method for making an air-tight seal between the window holder and the chamber are described. (M.P.G.)

1056

CALCULATION OF THE NUMBER OF EVENTS OF A CERTAIN TYPE PRODUCED IN A GIVEN VOLUME OF NUCLEAR EMULSION BEGINNING WITH AN ANALYSIS OF THE TRACKS. M. Gailloud, Ch. Haenny, and R. Weill. Helv. Phys. Acta 27, 467-80(1954) Oct. (In French)

After developing several criteria that can be used for the selected counting of tracks, mathematical relations are established which allow the calculation of a number of nuclear events that are produced in a given emulsion volume. The conditions for utilizing the criteria are indicated, together with the advantages and disadvantages of each. (tr-auth)

MESONS

1057

A NEGATIVE MUON BEAM AND ITS ANALYSIS BY A RADIOCHEMICAL METHOD. Lester Winsberg (Univ. of Chicago, Ill.). Rev. Sci. Instr. 25, 1079-82(1954) Nov.

A negative muon beam effectively free of pions and secondary particles has been obtained at the 102 Mev π^- channel of the Chicago synchrocyclotron by placing a graphite filter 36.0 g/cm^2 thick in the beam. The emerging muons were magnetically deflected from the main beam and their energy was shown to be about 50 Mev. A radiochemical method for determining the π^-/μ^- ratio in the range 10 to 0.01 was used to demonstrate the purity of the negative muon beam. Although not directly tested, this method for producing a muon beam should work equally well with positive muons. (auth)

1058

CLOUD-CHAMBER EVIDENCE FOR A CHARGED COUNTERPART OF THE θ^0 PARTICLE. A. L. Hodson, J. Ballam, W. H. Arnold, D. R. Harris, R. Ronald Rau, George T. Reynolds, and S. B. Treiman (Princeton Univ., N. J.). Phys. Rev. 96, 1089-95(1954) Nov. 15.

A photograph obtained in a Wilson cloud chamber, operated in a magnetic field, shows the following unusual event: a positive particle, produced in an interaction above the cloud chamber, decays in flight into a positive particle less massive than a K meson. Four other lightly ionizing particles also originate from the decay point; these appear in the form of two small-angle pairs, each pair consisting of one positive and one negative particle. The observed momenta and ionizations are consistent with three of these four particles being either electrons or mesons; the fourth must be an electron. The event may be interpreted as the decay:

$K^+ \rightarrow \begin{pmatrix} \pi^+ \\ \mu^+ \end{pmatrix} + \pi^0 + Q$ Mev, followed by the decay of π^0 meson into four electrons (a possible but hitherto unobserved mode of decay): $\pi^0 \rightarrow e^+ + e^- + e^+ + e^-$. This interpretation leads to a remarkable internal consistency of the data and is supported by the following experimental facts: (i) There is good over-all transverse-momentum balance in two mutually perpendicular planes. (ii) If all the particles in the above group of four are electrons resulting from the decay of a neutral particle the mass of the latter, determined from energy-momentum balance, is the $(255_{-10}^{+15})m_e$, in good agreement with the known mass of the π^0 meson. (iii) A transformation to the rest system of the π^0 meson shows that in this frame the four electrons come off as two small-angle pairs traveling in opposite directions. This is the most probable configuration in the four-electron decay of a π^0 meson. The Q values calculated for the K^+ decay are: $Q(\pi^+, \pi^0) = (213_{-10}^{+15})$ Mev and $Q(\mu^+, \pi^0) = (207_{-10}^{+15})$ Mev. Comparison of the first Q values with that for the θ^0 particle $Q(\pi^+, \pi^-) = 214 \pm 5$ Mev suggests that the unstable meson observed in this event and designated phenomenologically above as a K^+ meson may be a charged counterpart of the θ^0 particle. This interpretation may explain at least some of the cases, observed by other workers, in which γ rays appear to be associated with S particles. Other possible interpretations of the event are considered. (auth)

1059

A FIVE PARTICLE DECAY OF A HEAVY MESON. G. S. Shrikantia (Univ. of Sydney, Australia). Nuovo cimento (9) 12, 807-8(1954) Nov. (In English)

An event is described which was observed in a stack of emulsions exposed in a balloon flight. The most plausible interpretation of the event is that a K particle decayed into a π meson and four electrons. (M.P.G.)

1060

ON THE POSITIVE EXCESS OF MESONS OF HIGH ENERGY. I. Filosofo, E. Pohl, and J. Pohl-Ruling (Istituto Nazionale di Fisica Nucleare, Sezione di Padova, Italy). Nuovo cimento (9) 12, 809-12(1954) Nov. (In English)

Experiments are described in which the excess of positive μ mesons over negative μ mesons in the energy interval from 1 to 21 Bev is measured. The ratio of positive to negative μ mesons varies from 1.212 to 1.257 and appears to be a slowly varying function of the energy of the mesons. (M.P.G.)

1061

ON THE γ-RAYS ASSOCIATED WITH S-PARTICLES. M. Annis and L. Taffara (Univ. of Padova, Italy) and B. Dequal (Univ. of Trieste, Italy). Nuovo cimento (9) 12, 813-14 (1954) Nov. (In English)

The integral probability for γ rays of energy greater than E_γ to be emitted in the decay of an S particle into a μ meson and a neutrino has been calculated. It is shown that the γ rays will tend to be emitted in the plane perpendicular to the line of flight of the μ meson. (M.P.G.)

MICROWAVES

1062

A MICROWAVE ABSORPTION CELL FOR REACTIVE MOLECULES. W. A. Hardy, P. Fletcher, and V. Suarez

(Columbia Radiation Lab., New York). Rev. Sci. Instr. 25, 1135(1954) Nov.

This note discusses the construction of the window seals and the Stark lead of a Stark modulation microwave absorption cell designed for the analysis of reactive molecules such as fluorides. (auth)

NEUTRONS

1063

MEASURING THE ABSOLUTE INTENSITY OF A SOURCE OF NEUTRONS. E. Rodriguez' Mayquez and C. Sanchez del Rio. Translated from Anales real soc. españ. fiz. y quim. Madrid 50A, 27-32(1954). 11p. (AEC-tr-1992)

An abstract of this paper appears in Nuclear Science Abstracts as NSA 8-3831.

1064

INTERNATIONAL NEUTRON-SOURCE CALIBRATIONS. D. J. Hughes (Brookhaven National Lab., Upton, N. Y.). Nucleonics 12, No. 12, 26-8(1954) Dec.

Nine major laboratories were visited to study methods used in calibrating neutron sources and to determine the consistency of present absolute calibrations. It was found that the calibrations are much more consistent than they were in 1951. Relationships among the calibrations are presented. Neutron source preparation and calibration are described. (M.P.G.)

1065

NEUTRON SPIN FROM MAGNETIC RESONANCE EXPERIMENT. C. P. Stanford, T. E. Stephenson, and Seymour Bernstein (Oak Ridge National Lab., Tenn.). Phys. Rev. 96, 983-4(1954) Nov. 15.

The magnetic resonance type of experiment used for the measurement of the gyromagnetic ratio of the neutron has been extended to give a demonstration of the neutron spin. The spin $(\frac{1}{2})$ is demonstrated uniquely by the measured transition probability as a function of the amplitude of the oscillating magnetic field. (auth)

NUCLEAR PHYSICS

1066

Laboratory for Nuclear Science, Mass. Inst. of Tech. PROGRESS REPORT [NO. 34 FOR THE PERIOD OF JUNE 1, 1954 THROUGH AUGUST 31, 1954]. Aug. 31, 1954. 67p. Contract AT(30-1)-905. (AECU-2973)

Nuclear Chemistry (Inorganic). Satisfactory extraction of carrier-free Tl(III) from deuteron-bombarded Hg targets was achieved by using β,β'-dichlorodiethyl ether to extract Hg(II) from HCl. Measurements of Mn^{52} from a deuteron-bombarded Cr target were continued for more than 13 half lives, giving a half-life value of 138 ± 2 hr for this isotope. Nuclear Chemistry (Organic). An unsuccessful attempt was made to prepare a mixed peroxide from the acid chloride of sulfone acid I and peranisic acid. Tritiated benzaldehyde was synthesized with good yield from 1-benzyl-2-cyano-1, 2-dihydroquinoline in tritiated water and sulfuric acid. The T content was 0.20 that of the water, a result explained by a T—to—H effect. Cosmic Rays. Mass measurements of four S particles with stopped secondaries were made. Stopping times for these particles range around the value of 1×10^{-9} sec. A high-pressure rectangular ionization chamber has been designed for measuring the mean free path of the N component of cosmic radiation. Neutron Physics. The Coulomb excitation of Pd, Cd, and

Ag has been studied by the emitted γ rays. Experimental and theoretical values of the bremsstrahlung produced by proton scattering are compared for Sn and Nb. ONR Generator. The proton spectrum resulting from an $Al^{27}(d,p)Al^{28}$ reaction was measured with a new 90-degree magnetic spectrograph. The scattering of protons and deuterons by Ca^{42}, Ca^{44}, and Ca^{49} was used to investigate energy levels in these nuclides. Cyclotron Group. Inelastic deuteron groups have been observed from deuteron bombardment of Li^7, Be^9, C^{12}, Na^{23}, Mg^{24}, and Al^{27}. Synchrotron Group. Neutron-proton coincidences from H_2O, D_2O, and Li were measured as a function of neutron angle resulting from synchrotron bombardment. Results of experiments on the photoproduction of π^0 mesons in nuclear emulsions are summarized. Other activation curves were obtained on the photoproduction of π^+ mesons from H and and π^6 mesons from C. (For preceding period see AECU-2943.) (K.S.)

1067

Oak Ridge National Lab.
PHYSICS DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING SEPTEMBER 10, 1954. J. L. Fowler and E. O. Wollan, eds. Dec. 14, 1954. 81p. Contract W-7405-eng-26. (ORNL-1798)

HIGH-VOLTAGE PHYSICS. The total neutron cross section of Li^6 has been remeasured, and the results yield for the 0.255-Mev resonance the characterization $J = \frac{5}{2}$, odd parity. The differential cross section for the elastic scattering of neutrons on nitrogen has been obtained in the energy range from 0.5 to 2.5 Mev. The following angular momentum and parity assignments have been established for the states in N^{15}: 1.12 Mev, $J = \frac{3}{2}$ minus; 1.401 Mev, $J = \frac{3}{2}$ minus; 1.595 Mev, $J = \frac{5}{2}$ minus; 1.779 Mev, $J = \frac{5}{2}$ plus. The elastic scattering of neutrons on normal boron and on Be^9 has been studied. It is shown that the 0.43- and 1.28-Mev neutron resonant levels in normal boron have, respectively, the assignments $J = 2$ plus and $J = 3$ minus. In Be^9 the levels at neutron resonant energies of 0.62 and 0.81 Mev have, respectively, the assignments $J = 3$ and $J = 2$, with the parities uncertain. In continued work with polarized neutrons from $Li^7(p,n)Be^7$, some finer details of the product polarization with O^{16} used as polarization analyzer have been observed which are consistent with 50% as the degree of polarization from the $Li^7(p,n)Be^7$ reaction at 42° to the beam. Measurements in which He^4 serves as analyzer give this polarization as $54 \pm 18\%$. The (p,n) thresholds for N^{15}, Mg^{25}, Mg^{26}, Cu^{63}, and Cu^{65} have been found to be, respectively, 3.783 ± 0.008, 5.294 ± 0.015, 5.074 ± 0.010, 4.226 ± 0.008, and 2.172 ± 0.005 Mev. The first three values agree well with calculated values based on coulomb energy. A neutron spectrometer has been used to study the $Li^7(d,n)Be^8$ reaction. The neutron spectrum shows only the ground and 3-Mev states in Be^8, contradicting the old photoplate studies. The angular distributions of both neutron groups are predominantly forward, probably indicating at least some stripping. "Coulomb-excited" γ radiation produced by protons and α particles has been the object of further study, especially as regards cross section and angular distribution of the radiation. The data obtained have been interpreted in terms of the following nuclear parameters: level position, angular momentum, parity and γ-ray transition matrix element. Gamma rays have been studied from proton capture and proton inelastic scattering on normal B. In addition, the angular distribution of the $C^{13}(p,\gamma)N^{14}$ ground-state γ ray has been studied at the 3.11-Mev proton resonance. The

angular distribution is consistent with the 10.43-Mev level in N^{14}, being characterized as J = 2 minus. RADIO-ACTIVITY AND NUCLEAR ISOMERISM. An improved total-absorption γ-ray scintillation counter has been constructed in which a large NaI crystal is surrounded by a large solution counter tank operating in anti-coincidence with the crystal. A reduction of about a factor of 10 in the Compton distribution or pair peaks is obtained. The decay scheme of Bi^{207} has been investigated to determine the presence or absence of two reported γ-ray lines, both of which are now found to be absent. Two new γ rays have been found in Sb^{124}, and the decay scheme has been worked out. A critical study has been made of the fast-neutron response characteristics of LiI crystals activated with Eu. Various single-crystal spectrometer arrangements have been compared in energy resolution with multiple-crystal arrangements. Four nuclear isomers of short half life not previously reported have been found in Ge, Cd, and Ir. New measurements are given for isomers produced by neutron irradiation of Zr, Ge, Yb, and Pb. The angular correlations of γ rays in cascade have been measured for certain excited states in Te^{124}, Pb^{207}, and Cr^{52}. NEUTRON DIFFRACTION. The perovskite compounds $LaRO_3$ have been studied for R = V, Cr, Mn, Fe, and Co, the middle three being found to be antiferromagnetic, with Cr and Fe of one structure type and Mn of another. X-ray studies of these compounds are also included. A newly installed neutron spectrometer with cryostat and magnetic field has been used to determine the nature of the ferro- and antiferromagnetic reflections. The atomic magnetic moments have been determined for the individual atoms in a series of Ni—Fe alloys. From these investigations it appears that ordering of the lattice has little or no effect on the component magnetic moments and that these values are dependent on the over-all lattice composition. The magnetic structure of Mn_2Sb has been determined from an investigation of single-crystal reflectivities with magnetized and unmagnetized samples. LOW-TEMPERATURE PHYSICS. A series of measurements of the susceptibility and specific heat of UI_3 in the liquid-He region suggest that the material becomes antiferromagnetic at 2.61°K and that a domain structure composed of antiferromagnetic regions separated by ferromagnetic domain walls exists. Further work on anhydrous $MnCl_2$ has established the validity of the unusual, double specific-heat peak previously reported, and it is tentatively suggested that this material undergoes two antiferromagnetic transitions. HEAVY-ION PHYSICS. Electron-loss cross sections for fast hydrogen atoms passing through various gases are reported. The energy range studied was 20 to 200 kev, and the stopping gases were hydrogen, helium, nitrogen, oxygen, neon, and argon. Curves are presented of the electron-capture cross sections for protons calculable from these data and the previously reported ratio of electron loss-to-capture cross sections. NEUTRINO RECOIL. Recoils from neutrino emission in A^{37} have been analyzed both magnetically and electrically, and peaks corresponding to Cl^{37} ions of charges 2+, 3+, and 4+ have been observed. At present the values of the recoil energy as determined from the two methods bracket within a volt the value of 9.6 ev predicted from the disintegration energy that is available. THEORETICAL PHYSICS. The problem of calculating the mass correction for the electron has been rephrased in a form amenable to exact calculation. Calculation of a simple case makes plausible the hypothesis that the diverging mass correction represents nothing but a failure of the

perturbation theory. The ORACLE has been used in obtaining electron-scattering phase shifts for various nuclear models, and the results are compared with available experimental data. (For preceding period see ORNL-1705.) (auth)

1068

NONUNIFORM CHARGE DISTRIBUTIONS AND μ-MESON CAPTURE. F. Ferrari and C. Villi (Univ. of Padova and Trieste, Italy). Phys. Rev. 96, 1159-60(1954) Nov. 15.

Extensive calculations were carried out to evaluate the transition probability for μ-meson capture in terms of several electric charge distributions, suggested by theoretical analyses of observations on μ-meson x-rays and high-energy electron-nucleus scattering. Results are tabulated for Be, C, D, Al, S, Ca, Fe, Zn, Ag, Sb, Ba, Hg, Pb, and U. (L.T.W.)

1069

ON NUCLEON-PROTON COLLISION WITH THE PRODUCTION OF MESONS. P. Colombino, S. Ferroni, G. Ghigo, and G. Wataghin (Univ. of Turin, Italy). Nuovo cimento (9) 12, 819-20(1954). (In Italian)

1070

NEUTRON-WIDTHS AND THE DENSITY OF NUCLEAR LEVELS. J. M. C. Scott (Cavendish Lab., Cambridge Univ., England). Phil. Mag. (7) 45, 1322-31(1954) Dec.

The theoretical relation between the level width and the mean spacing D of the levels is investigated, using a model with strong configuration-mixing, not strong enough however to destroy the size resonance effect. Rough numerical values of Γ/D are obtained using a previous analysis of the size resonance effect in the thermal-neutron cross sections. The lack of sharpness of the surface of the nucleus has been taken into account, and is responsible for a factor of two or three in the calculated level widths. (auth)

NUCLEAR PROPERTIES

1071

Laboratory for Nuclear Science, Mass. Inst. of Tech. EXCITATION OF HEAVY NUCLEI BY THE ELECTRIC FIELD OF LOW-ENERGY PROTONS. Clyde L. McClelland, Hans Mark, and Clark Goodman. Oct. 15, 1954. 114p. Contract N5ori-07806, Technical report No. 66. (NP-5435)

The new experimental technique, electric excitation of nuclei, has been used to study the low-lying level structure in heavy nuclei. Experimental data for seventeen nuclides are presented, including isotopes of lutetium, hafnium, tantalum, tungsten, rhenium, and platinum. Excitation of twenty-five levels in these nuclei was observed, thirteen of which were previously unknown. These data have been interpreted to give both qualitative and quantitative support to the nuclear model proposed by Bohr and Mottelson. Their hypothesis of rotational states of the nucleus is further confirmed by this work. Approximate intrinsic quadrupole moments of these nuclides have been determined from the experimental data, including the even-even nuclei studied. (auth)

1072

LIFE-TIME OF THE FIRST EXCITED STATE OF Ni^{60}, Ba^{134}, Pd^{106} AND Re^{185}. Veljko Z. Wintersteiger. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 4, 79-82 (1954) June. (In English)

The lifetimes of the first excited states of Ni^{60}, Ba^{134}, Pd^{106}, and Re^{185} were measured by a method of delayed

coincidences. It was established that Re^{186} has a half life of not greater than 10^{-9} sec and that the other three isotopes have half lives not exceeding 5×10^{-10} sec. Experimental deviations in the expected values of the angular correlations are discussed in the light of the results. (M.P.G.)

1073

NEUTRON-CAPTURE CROSS SECTIONS BY CAPTURE-GAMMA COUNTING. Edward Meservey (Columbia Univ., New York). Phys. Rev. 96, 1006-13(1954) Nov. 15.

A method is described for determining neutron capture cross sections and locating capture resonances by capture gamma counting. Breit-Wigner parameters for the strong resonance in cadmium are determined to be $E_0 = 0.177$ ev, $\sigma_{c0} = 7600$ barns, $\Gamma = 0.110$ ev. Resonances have been found in cadmium at 19 and 28 ev with evidence of unresolved resonances at about 100 ev and above; $\sigma_{c0}\Gamma \cong 3$ barn-ev for the 19-ev level, and $\sigma_{c0}\Gamma^2 \cong 9$ barn $(ev)^2$ for the 28-ev level. Comparison transmission measurements on cadmium show the capture-gamma method to be quicker and more sensitive under some circumstances than transmission measurements for locating weak capture levels. Factors affecting the relative sensitivity of the two methods are discussed. A resonance was found in strontium at 3.58 ev; its strength $(\sigma_{c0}\Gamma^2)$ is approximately 8 barn-$(ev)^2$. Resonances were found in barium at energies of 25, 93 and 380 ev, with strengths $(\sigma_{c0}\Gamma^2)$ estimated to be 8, 90, and 550 barn $(ev)^2$, respectively. Measurements on a thick silver sample show that the method can be used to measure σ_c / σ_t through a resonance over a fairly large range of values of transmission and cross sections. The strength of the 5.13-ev resonance in silver is determined to be $\sigma_{c0}\Gamma^2 = 345 \pm 30$ barn $(ev)^2$. (auth)

1074

ZEEMAN SPLITTING OF NUCLEAR QUADRUPOLE RESONANCES. C. Dean (Univ. of Pittsburgh, Penna.). Phys. Rev. 96, 1053-9(1954) Nov. 15.

The theory of the Zeeman splitting of the pure quadrupole energy levels for nuclei of half-integral spin is given in a form that is correct for any electric field gradient. The splitting of the spectra is discussed and also the simplifications that can be made in the theory when the magnetic field is parallel to any of the three principal axes of the electric field gradient. For spin $\frac{3}{2}$ it is shown that the deviation of the gradient from cylindrical symmetry can be determined from the Zeeman spectrum, and detailed calculations are given for this case, along with a discussion of their experimental application. (auth)

1075

PARTICLE DERIVATION OF NUCLEAR ROTATION PROPERTIES ASSOCIATED WITH A SURFACE WAVE. D. R. Inglis (Argonne National Lab., Lemont, Ill.). Phys. Rev. 96, 1059-65(1954) Nov. 15.

The dynamical conception of nuclear rotation in terms of a surface wave on a droplet of irrotational fluid has achieved some success in spite of the great differences between nucleons and the particles of a normal classical fluid. As a justification for the simplifying assumption of irrotational fluid flow, the collective rotational energy is derived from a suitable set of nucleon wave functions in the approximation in which there is a rotating distortion, slow compared with the internal nucleon motions. The wave functions are those of a three-dimensional harmonic oscillator that is made anisotropic by having the force constant along one axis different from those along the other two in a rotating carte-

sian coordinate system. For the case of steady rotation about a fixed axis, the perturbation problem with first-order wave functions leads to a second-order rotational energy which agrees with the droplet-model result. The observed level spacings appear to lie between this result and that of a rigid rotator, and the discrepancy is probably to be attributed to higher orders. The result is also derived by another method without introducing a steady rotation. (auth)

1076

EFFECT OF NUCLEAR CHARGE ON INTERNALLY PRODUCED PAIRS. G. K. Horton (National Research Council of Canada, Ottawa and Univ. of Alberta, Edmonton, Canada) and E. Phibbs (Univ. of Alberta, Edmonton, Canada). Phys. Rev. 96, 1066-75(1954) Nov. 15.

The effect of nuclear charge on internally converted pairs is investigated using the relativistic Sommerfield-Maue solutions of the iterated Dirac equation. The orthonormal properties of these wave functions are studied, and time-dependent perturbation theory is adapted to allow for their nonorthogonality. The integrals involved are studied using the Fourier transforms of the wave functions. The matrix elements are obtained in terms of one fundamental integral, evaluated by using an integral representation of Butler. The procedure is very simple and promises generalizations. The matrix elements are shown to be complex only through $n = iZ/(137v_{\pm})$, where $v_{\pm}$ is the velocity of the positron or the negatron and Z is the nuclear charge. The following conclusions are drawn. Firstly, the first Born approximation results when multiplied by the well-known Sommerfeld factors of the negatron and positron are accurate to a term proportional to $|n|^2$. For 5-percent resolutions, $Z \lesssim 20$, the kinetic energy must be more than 100 kev. Secondly, this result is valid for all electric and magnetic multipole transitions. Finally, this result is shown to apply to all transitions taking place between unbound states and to hold for higher order perturbation terms. (auth)

1077

EVIDENCE FOR TWO-BODY SPIN-ORBIT FORCES IN NUCLEI. J. P. Elliott and A. M. Lane (Atomic Energy Research Establishment, Harwell, Berks, England). Phys. Rev. 96, 1160-2(1954) Nov. 15.

Properties of nuclei can be explained on the basis of a shell model in which one-body spin-orbit forces of the type $\xi(l \cdot s)$ are assumed in addition to two-body central forces. Experimental evidence suggests that a force of the simple type $\xi(l \cdot s)$ may not be a real force in the nucleus but rather that it is a caricature of a more complicated force. It has been suggested that this may be a tensor force or a two-body spin-orbit force. In the present paper the second type of force was investigated: $T(12)\{\vec{\sigma}_1 + \vec{\sigma}_2\} \cdot [(\vec{r}_1 - \vec{r}_2) \times (\vec{p}_1 - \vec{p}_2)]\}V(r_{12})$, where $T(12)$ may be 1 (neutral) or $(\vec{\tau}_1 \cdot \vec{\tau}_2)$ (symmetric) and where $V(\vec{r}_{12})$ is some potential which was taken to be $V(r_{12}) = V_0 \exp(-r_{12}/a)/r_{12}/a$. (L.T.W.)

1078

DIFFERENCES OF MASS. A. Petermann (Univ. of Manchester, England). Helv. Phys. Acta 27, 441-50(1954) Oct. (In French)

Distribution theory, in the Stueckelberg form, leaves undetermined the customarily divergent expressions appearing, for instance, in the self-mass terms; this indeterminacy can be embodied in an arbitrary constant C which acts as an invariant cut-off, independent of the physical quantities of the problem under consideration. Considering

the electromagnetic self-energies of charged particles, the value of the constant C can be fixed by requiring the mass shift between π mesons to be $10 m_e$. Next, taking into account the effects of π mesons coupling with nucleons, a form factor $F(k^2)$, taken over from the lowest order of the ps-ps symmetric perturbation theory, is introduced for the computations of the effects due to the anomalous magnetic momenta and attractive proton-proton short range interaction, with a phenomenological normalization of $F(0)$. Then the difference between proton and neutron masses, calculated with the above C value, yields about $-2.6\ m_e$, fitting well with the observation. Some arbitrariness left by the procedure is discussed, showing the insensitivity of the result. Thus it seems probable that the mass shifts are of electromagnetic nature. (auth)

1079

THE HARMONIC MEAN ENERGY FOR PHOTON ABSORPTION BY NUCLEI. J. Goldemberg (Univ. of Sao Paulo, Brazil) and J. Leite Lopes (Centro Brasileiro de Pesquisas Fisicas and Faculdade Nacional de Filosofia, Rio de Janeiro, Brazil). Nuovo cimento (9) 12, 817-18(1954) Nov. (In English)

The expectation value of the squared displacement of a nucleon in the nuclear ground state has been determined for a number of nuclei utilizing experimental data on the harmonic mean energy for photon absorption by nuclei. The model of a nucleus in which the nucleons are clustered in α particles as subunits is substantiated. (M.P.G.)

NUCLEAR REACTORS

1080

Atomic Energy Research Establishment, Harwell, Berks (England)
LIQUID METAL COOLANTS. BIBLIOGRAPHY. J. E. Terry and N. B. Skeats. July 1954. 21p. (AERE-Inf/Bib-94)

A bibliography of unclassified reports and literature references supplementing, A.E.R.E., Inf./Bib. 89 and A.E.R.E. Inf./Bib. 89 (Supplement 1) and containing references up to mid-June, 1954 on liquid metal coolants is presented. (auth)

1081

PRODUCING PLUTONIUM IN $U-D_2O$ REACTORS. M. Bogaardt and M. Bustraan (Joint Establishment for Nuclear Energy Research, Lillestrom, Norway). Nucleonics 12, No. 12, 32-5(1954) Dec.

The Pu production rate and reactivity behavior during running periods on the order of 10^7 sec have been investigated for heavy water reactors. The variation with time of conversion ratios and multiplication factors in infinite, bare, reflected, and enriched lattices is presented in graphical form. The effects of fuel enrichment on the limiting value of the initial conversion ratio and on the critical radius of a bare reactor are also presented. (M.P.G.)

1082

AUTOMATIC CONTROL OF A NUCLEAR REACTOR. Pierre Bonnaure, Paul Braffort, Israël Pelchowitch, and Jacky Weill (Commissariat a l'Energie Atomique, Centre d'Etudes Nucleaires de Saclay). J. Nuclear Energy 1, 24-38(1954) Aug. (In French)

An automatic control for nuclear reactors is described. It is actuated by an error signal corrected by a signal which is proportional to the reactivity. It is demonstrated that such a system is stable. Experimental results obtained with the Saclay pile are presented and are shown to agree with the theory. Stability of better than 0.1 per cent is easily achieved in steady runs, as well as safety when power is changed. (auth)

1083

OPERATIONAL FEATURES OF ZEPHYR. J. E. R. Holmes, D. D. McVicar, H. Rose, L. R. Shepherd, R. D. Smith, and A. M. Smith (Atomic Energy Research Establishment, Harwell, Berks, England). J. Nuclear Energy 1, 47-52(1954) Aug.

Zephyr is a small low-power fast reactor with a core made up of plutonium and natural uranium sections surrounded by a uranium envelope. The reactor is controlled by moving sections of uranium near the core to vary the fraction of neutrons that may escape from the latter. Power level measurement is carried out by pulse-operated fission chambers with both linear and logarithmic ratemeters as indicators. Initial studies have included the investigation of the delayed neutrons and their influence on the reactor kinetics. (auth)

1084

EFFECT OF PHOTONEUTRONS ON THE TRANSFER FUNCTION OF A HEAVY-WATER REACTOR. Arne Lundby (Joint Establishment for Nuclear Energy Research, Kjeller, Norway). J. Nuclear Research 1, 53-6(1954) Aug.

The transfer function of JEEP as a function of the photoneutron intensity in the reactor has been measured and compared with theory. Reactor oscillator experiments are found to be ambiguous at power levels below a few kilowatts. (auth)

1085

DETERMINATION OF THE CHARACTERISTICS OF THE NEUTRON SPECTRUM FROM A NUCLEAR REACTOR. Drogoslav D. Popovic (Joint Establishment for Nuclear Energy Research, Kjeller, Norway). Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 4, 83-8(1954) June. (In English)

Formulas for the energy spectra of fast neutrons, epithermal neutrons, and thermal neutrons from a reactor are given. The experimental determination of the constants in the formulas is described. (M.P.G.)

1086

NOMOGRAPHIC DETERMINATION OF THE THERMAL UTILIZATION FACTOR. Miodrag M. Novakovic. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 4, 89-95 (1954) June. (In English)

A formula for the thermal utilization factor in a heterogeneous reactor is derived. The formula can be used for a nomograph, and a nomograph is given for the case of $U-D_2O$ lattices with air cooling. A second nomograph is given for the correction term in the case of lattices containing aluminum cannings. (M.P.G.)

NUCLEAR TRANSFORMATION

1087

PROTON GROUPS FROM THE REACTION $O^{18}(d,p)O^{19}$. Curt Mileikowsky and Katarina Ahnlund (Nobel Inst. of Physics, Stockholm, Sweden). Phys. Rev. 96, 996-8(1954) Nov. 15.

Separated targets of O^{18} on thick and thin backings have been used in a search for proton groups from the reaction $O^{18}(d,p)O^{19}$. Three proton groups due to this reaction were

found. Their energies were measured with a double focusing magnetic spectrometer which in this case was calibrated with known particle group energies from $B^{10}(d,p)B^{11}$ and $N^{14}(d,p)N^{15}$. The Q values of $O^{18}(d,p)O^{19}$ are $Q_1 = 1730 \pm 8$ kev, $Q_2 = 1636 \pm 8$ kev, and $Q_3 = 262 \pm 6$ kev. (auth)

1088

MAGNETIC ANALYSIS OF THE $O^{17}(d,p)O^{18}$ REACTION.
Katarina Ahnlund (Nobel Inst. of Physics, Stockholm, Sweden). Phys. Rev. 96, 999-1000(1954) Nov. 15.

Separated isotopic targets of O^{17} were used to study the reaction $O^{17}(d,p)O^{18}$. The energy spectrum of protons from this reaction has been analyzed at 61.0° and 134.7° to the incident 0.855-Mev deuteron beam, using a double focusing magnetic spectrometer and photographic detection. The survey covers a range of excitation in O^{18} from 0 to 4.8 Mev. Two proton groups were identified with the reaction $O^{17}(d,p)O^{18}$, giving $Q_0 = 5821 \pm 10$ kev and $Q_1 = 3835 \pm 8$ kev. (auth)

1089

MAGNETIC ANALYSIS OF THE $Co^{59}(d,p)Co^{60}$ REACTION.
G. M. Foglesong and D. G. Foxwell (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 96, 1001-2(1954) Nov. 15.

Proton groups from cobalt targets bombarded with 5-Mev deuterons from the MIT-ONR electrostatic generator have been analyzed with a 180-degree focusing magnetic spectrograph. The ground-state Q value for the $Co^{59}(d,p)Co^{60}$ reaction was found to be 5.283 ± 0.008 Mev. The 60-kev metastable state and thirty-four additional excited states were observed and their Q values measured. (auth)

1090

RADIATIVE CAPTURE OF DEUTERONS BY He^3. J. M. Blair, N. M. Hintz, and D. M. Van Patter (Univ. of Minnesota, Minneapolis). Phys. Rev. 96, 1023-9(1954) Nov. 15.

The excitation function of $He^3(d,\gamma)$ capture radiation, measured from $E_d = 0.2$ to 2.85 Mev, exhibits a broad resonance at 0.45 ± 0.04 Mev, with a total cross section of 0.05 ± 0.01 mb. Above this energy, the presence of nonresonant capture is observed at $E_d = 0.58$ Mev, the radiation is isotropic from 0° to 90° within ±10 percent. The measured gamma-ray energy of 16.6 ± 0.2 Mev at resonance corresponds to a Q value for the $He^3(d,\gamma)Li^5$ reaction of 16.36 ± 0.2 Mev. The experimental radiation width at resonance is calculated to be 1 ± 2 ev, which is compared to the Weisskopf estimate for E1 transitions. (auth)

1091

REACTIONS OF COBALT WITH PROTONS AT 60, 100, 170, AND 240 MEV. Genevieve D. Wagner and Edwin O. Wiig (Univ. of Rochester, N. Y.). Phys. Rev. 96, 1100-3(1954) Nov. 15.

Absolute cross sections are reported for the production of the nuclides Co^{58}, Co^{56}, Co^{55}, Fe^{52}, Mn^{56}, Mn^{52}, Mn^{51}, Cl^{39}, and $Cl^{38,34}$ from bombardment of Co^{59} with protons of energies 60, 100, 170, and 240 Mev. The yields appear to be accounted for at the lower energies by a combination of compound nucleus model, knock-on cascade model and for the production of chlorine isotopes a fission mechanism. A knock-on cascade model together with a fission mechanism may be used to explain the yields at the higher energies. (auth)

1092

RESONANCES IN THE PROTON BOMBARDMENT OF C^{14}.
G. A. Bartholomew, F. Brown, H. E. Gove, A. E. Litherland, and E. B. Paul (Atomic Energy of Canada Limited, Chalk River). Phys. Rev. 96, 1154-6(1954) Nov. 15.

The $C^{14}(p,\gamma)N^{15}$ reaction was studied from 0.25 to 1.8 Mev. A previously unreported broad resonance was observed in this reaction at a proton energy of 1.50 Mev. Resonance parameters are reported. (L.T.W.)

1093

STUDY OF THE VARIATION OF Pu^{239} FISSION CROSS SECTION IN THE THERMAL AND EPITHERMAL REGION.
Georges Vendryes, Pierre Hubert, and Jean-Michel Auclair. Compt. rend. 239, 1034-6(1954) Oct. 27. (In French)

A neutron diffraction spectrometer was used to compare, as a function of energy, the fission cross section of Pu^{239} to that of the $B^{10}(n,\alpha)Li^7$ reaction. The curve obtained shows that in the region studied (0.01 to 0.95 ev), Pu^{239} has a fission resonance at 0.300 ± 0.005 ev, with a width of 0.09 ± 0.01 ev. (tr-auth)

1094

RELATIVE MEASUREMENT OF THE FISSION CROSS SECTION OF PLUTONIUM FOR SLOW NEUTRONS. Magda Galula, Bernard Jacrot, and Francis Netter. Compt. rend. 239, 1128-30(1954) Nov. 3. (In French)

The variation in the fission cross section of Pu with energy is determined for slow neutrons, giving a resonance near 0.3 ev. The half-width of the resonance peak is 0.04 ev. The results are compared with those of U. (tr-auth)

1095

INVESTIGATIONS ON THE REACTION $^7Li(\gamma,\alpha)^3H$. P. Erdös, P. Stoll, and M. Wächter (Federal Inst. of Tech., Zurich, Germany) and V. Wataghin (Istituto Nazionale di Fisica Nucleare, Milan, Italy). Nuovo cimento (9) 12, 639-48(1954) Nov. (In English)

The reaction $Li^7(\gamma,\alpha)H^3$ is studied by exposing lithium-loaded nuclear emulsions to the radiation from a 31-Mev betatron. The cross section as a function of γ-ray energy is measured, and excited states of Li^7 are found at 4.7, 5.5, 6.8, 8.3, and 9 Mev. The first three levels have a relative intensity of 1:0.75:0.75. The angular distribution analysis allows one to exclude certain possible values of the spin for the levels at 4.7, 5.5, and 6.8 Mev. The absolute value of the cross section is obtained from the known $C^{12}(\gamma,3\alpha)$ cross-section data. A selection rule which limits the number of low-energy levels is discussed. (auth)

PARTICLE ACCELERATORS

1096

Atomic Energy Research Establishment, Harwell, Berks (England)
FABRICATION OF TITANIA DIELECTRICS FOR LINEAR ACCELERATORS. J. Billing and P. Murray. Nov. 1950. 13p. (AERE-M/R-606)

The fabrication of pure titania has been investigated for use as wave guides in linear accelerators. Theoretical considerations suggest that the required dielectric constant of 90 to 95 can only be obtained in pure titania provided the porosity of the sample is less than 5%. Furthermore, the power loss factor is sensitive to the presence of free electrons produced by reduction of titania (TiO_2) to lower valency states, and such reduction must be avoided in fabrication. Hot pressing in graphite dies is unsatisfactory for this latter reason. Cold pressing, followed by sintering in different atmospheres, and the effect of small additions of bentonite, have been tried. It has been found that: (a) sintering in air at 1550°C yields porosities of approximately 9% together with formation of lower oxides; (b) sintering in oxygen at 1500°C results in a slight improvement in the

sintered density (7% porosity), but formation of lower oxides persists; (c) additions of up to 2% bentonite and sintering in oxygen at 1500°C provided samples with less than 5% porosity. The bentonite additions apparently form a protective liquid film at high temperature, which prevents dissociation of the oxide. (auth)

1097

Atomic Energy Research Establishment, Harwell, Berks (England)
FOCUSING SYSTEM FOR THE 600 MeV. PROTON LINEAR ACCELERATOR. M. Bell and W. Walkinshaw. Aug. 1954. 20p. (AERE-T/M-122)

Detailed calculations have been made for the radial motion of the synchronous protons of the 600-Mev linear accelerator. Acceleration up to 10 Mev is obtained with grid focusing, presenting a beam estimated to be of 1 cm diameter with a divergence of 0.2°. The phase spread of the protons at 10 Mev is roughly ± 15° about the stable phase of 30°. In the present memorandum the design of the strong-focusing system to be used above 10 Mev is discussed. It is shown from aperture considerations that the 10 Mev beam will be accelerated without loss with magnetic focusing of the order of 1500 gauss, at 10 Mev decreasing roughly inversely with velocity to 50 Mev. At this energy the field has to be increased to 1500 gauss because of the r-f wavelength change but will decrease again at higher energies. (auth)

1098

[European Council for Nuclear Research]
GENERAL CONSIDERATIONS ON THE POWER SUPPLY FOR THE MAGNETS OF HIGH-ENERGY PROTON-SYNCHROTRONS. F. Grutter. Dec. 1954. 16p. (CERN-PS/FG-1)

There are several different possibilities for powering the magnet coil of high-energy synchrotrons; their advantages and disadvantages are discussed. It appears that a motor-alternator set with a converter group composed of mercury-arc valves will be the best solution from both technical and economic points of view. The operating principle of such an equipment is described in some detail. (auth)

1099

[European Council for Nuclear Research]
THE EFFECT OF STRAIGHT SECTIONS OF DIFFERENT LENGTHS IN A S. F. S. Kjell Johnsen. Jan. 22, 1953. 3p. (CERN-PS/KJ-14)

The stability condition for a strong-focusing synchrotron in which every second straight section has the length L_1 and the other ones have the length L_2 is evaluated. It is shown that in all practical cases a good approximation is obtained if this system is replaced in the calculations by a system in which all straight sections are equal and of a length equal to the mean value of L_1 and L_2. (auth)

1100

[European Council for Nuclear Research]
SOME THOUGHTS ABOUT POSSIBLE METHODS TO COMPENSATE FOR PERTURBATIONS ON THE FREE OSCILLATIONS CAUSED BY UNAVOIDABLE INHOMOGENEITIES. Kjell Johnsen. Feb. 18, 1953. 3p. (CERN-PS/KJ-16)

Magnet inhomogeneities or misalignment in a synchrotron may give rise to unwanted betatron oscillations. It is suggested that the addition of small magnet sections or separate windings on the main magnet sections might com-pensate for the unwanted perturbations by providing perturbations of the same amplitude but 180° out of phase. (M.P.G.)

1101

[European Council for Nuclear Research]
SOME NUMERICAL DATA FOR EIGHT DIFFERENT ALTERNATIVES OF A STRONG FOCUSING SYNCHROTRON HAVING AN AVERAGE RADIUS OF 150 M AND GIVING 30 GeV PROTONS. Kjell Johnsen. Apr. 4, 1953. 4p. (CERN-PS/KJ-17)

Data for eight alternatives for a synchrotron giving 30-bev protons are presented. The alternatives are of two types, one in which the same magnets are employed for focusing and bending and the other having special focusing sections with no bending action. The advantages of each are discussed. (M.P.G.)

1102

A 15 MEV LINEAR ACCELERATOR FOR MEDICAL USE. Electronic Eng. 26, 527-8(1954) Dec.

A linear accelerator of the traveling-wave tube type for medical use is described. The final electron energy is 15 Mev. The accelerator will be a source of high-energy x rays and fast neutrons as well as of the electron beam. (M.P.G.)

RADIATION ABSORPTION AND SCATTERING

1103

Consolidated Vultee Aircraft Corp.
ANGULAR NEUTRON SCATTERING CROSS SECTIONS FOR AIR. G. S. Weller and B. J. Workman. Dec. 4, 1953. Revised Aug. 24, 1954. 12p. (CVAC-251I; MR-A-342 (rev.))

The angular elastic scattering cross section in air was calculated for neutrons with energies of 0.3, 1.0, and 3.0 Mev. The calculations were based on an average air nucleus. The expression used to obtain the data is given, and the data are presented in a table and graphs. (M.P.G.)

1104

Consolidated Vultee Aircraft Corp.
SPACE DISTRIBUTION OF GAMMA FLUX. THE SINGLE SCATTERED COMPONENT. J. J. Billings. Oct. 12, 1953. 16p. (CVAC-258T; MR-A-319)

The space distribution of singly scattered γ rays has been calculated for air. Calculations are based on a receiver-source distance of 65 feet. Tables are presented for energies of 0.5, 1.25, 3.0, and 6.0 Mev giving the scattering energy per photon and doses attenuated and unattenuated by air for 153 volumes of revolution. (M.P.G.)

1105

Lewis Flight Propulsion Lab., NACA
SLOWING-DOWN DISTRIBUTION TO INDIUM RESONANCE OF NEUTRONS FROM A Ra-α-Be SOURCE IN WATER-IRON MIXTURES. Daniel Fieno. [Aug. 10, 1954]. 16p. (NACA-RM-E54H04)

The mean square slowing-down distance to indium resonance $\bar{r}^2$ derived from the slowing-down distribution has been measured for water and for three water-iron mixtures for neutrons from a 0.1-gram Ra-α-Be source. The values of $\bar{r}^2$ for water-iron volume ratios of 1, 2, and 3 and for water were 347, 336, 314, and 291 cm^2, respectively. Within the accuracy of the measurements, the relaxation length λ was approximately the same for water and for the three water-iron mixtures, the average value being 10.0 centimeters. (auth)

1106

Nuclear Development Associates, Inc.
NEUTRON PENETRATION IN HYDROGEN. R. Aronson.
June 11, 1954. 23p. Contract AT(30-1)-862. (NDA-15C-39)

Results for doses and buildup factors are given for the
penetration of neutrons through hydrogen as computed by
the moment method. Comparisons are made with a Monte
Carlo calculation and a calculation by a method due to
Welton. A discussion of an anomalous flux at zero energy
is included. (auth)

1107

Nuclear Development Associates, Inc.
DISTRIBUTION OF FISSION NEUTRONS IN WATER AT
THE INDIUM RESONANCE ENERGY. J. Certaine and
R. Aronson. June 15, 1954. 17p. Contract AT(30-1)-862.
(NDA-15C-40)

Calculations were made by the moment method of the
neutron flux distribution at 2.03 ev from a point isotropic
fission source in water. Comparison was made with flux
measurements by Hill, Roberts, and Fitch (ORNL-181) at
the indium resonance energy (~1.44 ev). The shapes of the
two flux curves agree beyond 10 cm. However, the maxi-
mum of the theoretical flux curve is ~5 cm from the origin
while the experimental maximum is ~7.5 cm away. The age,
defined as $\bar{r}^2/6$ (r being the distance from the origin), is
calculated to be 26 cm^2, compared to a measured value of
31 cm^2. (auth)

1108

Carnegie Inst. of Tech.
ELASTIC SCATTERING OF 160 MEV MESONS BY PRO-
TONS IN NUCLEAR EMULSIONS. Raymond Alvin Grandey.
June 1954. 60p. Contract AT(30-1)-882. (NYO-6568)

Nuclear emulsions have been exposed to the external
nominal 160-Mev negative and positive pion beams of the
Carnegie synchrocyclotron. The plates have been scanned
for elastic pion-proton scattering events. A total cross
section for negative pion-proton direct scattering of
17.9 ± 3.6 mb has been measured at 160 ± 7 Mev, based up-
on 23 events. Seventy elastic events have been found while
scanning plates exposed to 151 ± 7-Mev positive pions,
which, combined with results obtained by Columbia and the
recent accurate determinations of the total cross section in
this energy region by the Carnegie group, yield a value for
the differential cross section of $d\sigma/d\Omega = (7.7 ± 7.2)-$
$(3.3 ± 2.4)\cos\theta + (17.3 ± 7.2)\cos^2\theta$ mb/ster. The best Fermi
type phase shifts calculated from the above are $\alpha_3 = -26.3°$,
$\alpha_{33} = 50.2°$ and $\alpha_{31} = -0.1°$. Recent data on pion-proton
scattering at various energies are discussed, and it is
found that the present data can be fitted with just three
phase shifts which can perhaps all be treated on
phenomenological models. (auth)

1109

MAGNETIC EFFECTS IN THE SCATTERING OF MUONS BY
NUCLEI. R. Gatto (Univ. of Rome, Italy). Nuovo cimento
(9) 12, 613-18(1954) Nov. (In English)

In connection with recent experiments on the scattering
of μ mesons by nuclei, the effect of the anomalous magnetic
moment of the incident muon and of the distribution of
currents in the nucleus have been evaluated. The results
are for nonpolarized beams incident on nonpolarized nuclei.
At relatively large angles the cross sections depend sen-
sitively on the way in which the charges and currents are
distributed in the nucleus. (auth)

1110

POLARIZATION OF PROTONS BY SCATTERING FROM
BERYLLIUM. H. G. De Carvalho, J. Marshall, and L.
Marshall (Univ. of Chicago, Ill.). Phys. Rev. 96, 1081-5
(1954) Nov. 15.

The polarization of high-energy protons scattered from
beryllium has been investigated as a function of energy
and angle of the scattered protons. It was found that the
elastically scattered protons are much more strongly polar-
ized than the quasi-free nucleon-scattered protons. (auth)

1111

TOTAL CROSS SECTIONS FOR NEGATIVE AND POSITIVE
PIONS IN HYDROGEN AND DEUTERIUM. J. Ashkin, J. P.
Blaser, F. Feiner, J. G. Gorman, and M. O. Stern (Carnegie
Inst. of Tech., Pittsburgh, Penna.). Phys. Rev. 96, 1104-15
(1954) Nov. 15.

External meson beams, ranging in energy from 135 to 260
Mev for the π^-, and 135 to 198 Mev for the π^+, have been
used for the measurement of total cross sections by an at-
tenuation experiment using liquid hydrogen as well as CH_2
and C as absorbers. Possible errors introduced by con-
tamination of the π^+ beam by protons have been eliminated
by use of time-of-flight and pulse-height discrimination.
The corrected cross sections for π^- mesons in hydrogen
rise from 47 mb at 133 Mev to a maximum of about 66 mb
near 180 Mev and fall thereafter to 38 mb at 258 Mev, with
typical uncertainties of ±5 percent. The cross sections for
π^+ mesons rise from 122 mb at 128 Mev to around 200 mb
between 170 Mev and 196 Mev, with accuracy comparable to
that for the π^- mesons except for the very high energies
where the beams are of low intensity. The π^+ cross sections
follow very well the curve representing three times the
total π^- cross section, indicating that in the measured ener-
gy range the dominant interaction between pion and nucleon
occurs for total isobaric spin I = $3/2$. Comparison of the π^-
cross section with $(6/9)\pi\lambda^2$ supports the idea that the partic-
ular angular momentum state J = $3/2$, L = 1 (for I = $3/2$) is
especially prominent in the scattering. The total cross sec-
tions for π^+ and π^- mesons interacting with deuterium have
also been measured by comparing the transmissions of D_2O
and H_2O cells. Within the accuracy, the π^+ and π^- total
cross sections are equal, consistent with the principle of
charge symmetry. The total scattering cross section of
deuterium is less than but of the same order of magnitude as
the sum of the hydrogen cross sections for π^+ and π^-. (auth)

1112

LIMITING PROCESSES IN THE FORMAL THEORY OF
SCATTERING. F. Coester, Morton Hamermesh, and Kat-
sumi Tanaka (Argonne National Lab., Lemont, Ill.). Phys.
Rev. 96, 1142-3(1954) Nov. 15.

The equivalence of different formal limiting processes
employed in the theory of scattering is discussed by com-
paring the integral equations which hold for finite values of
the parameter. (auth)

1113

SOLUTION OF MANY-BODY SCATTERING PROBLEMS BY
FREDHOLM'S EQUATION. P. Swan (Univ. of Melbourne,
Australia). Phys. Rev. 96, 1144(1954) Nov. 15.

A reduction is made of the second-order linear integro-
differential equation describing many-body elastic collisions
to a Fredholm equation, for which an analytic solution can
be constructed. The Fredholm equation is easier to solve
numerically, an example being solved by iteration as an
illustration of its use. (auth)

1114

DIRECT INTERACTION IN $Fe^{54}(p,p')Fe^{54*}$. G. Schrank, P. C. Gugelot, and I. E. Dayton (Princeton Univ., N. J.). Phys. Rev. 96, 1156-7(1954) Nov. 15.

Austern, Butler, and McManus (Phys. Rev. 92, 350 (1953)) in order to explain large observed (n,p) and (n,α) cross sections proposed a new mechanism which describes the reaction as a consequence of an interaction between the incoming particle and one of the nucleons at the surface of the nucleus in place of an interaction between the bombarding particle and the whole nucleus. In the present paper the angular distribution of protons inelastically scattered from Fe was investigated to test this hypothesis. (L.T.W.)

1115

ELASTIC SCATTERING OF NEUTRONS BY NUCLEI IN MOTION. Fernando E. Prieto C. (Instituto de Fisica de la Universidad Nacional de Mexico e Instituto Nacional de la Investigacion Cientifica). Rev. mex. fis. 3, 137-65(1954) July. (In Spanish)

A generalization of the well known treatment of the elastic scattering of neutrons by a nucleus at rest is presented in this paper. Assuming an initial motion for the scatterer nucleus, a discussion is made of the scattering of neutrons in both the laboratory and the center of mass frames of reference. An expression is obtained for the scattering function, and the final energy of the scattered neutron is fully discussed. (auth)

1116

(γ, α)-REACTIONS ON Li^7, N^{14}, AND O^{16}. P. Stoll (Physikalisches Institut der Eidge. Techn. Hochschule, Zurich, Germany). Helv. Phys. Acta 27, 395-416(1954) Oct. (In German)

Photographic plates, loaded with lithium, have been exposed to γ rays up to 31 Mev. The following reactions were observed and their cross sections determined: Li^7 (γ, α) H^3; N^{14} (γ, α) B^{10}; and O^{16} (γ, α) C^{12}. Excited states of the Li^7 nucleus have been found at E^* = 4.7; 5.5; and 6.8 Mev. Respecting the O^{16}(γ, α)C^{12} reaction, the isobaric spin selection rules permit conclusions on the character of absorption of the γ radiation. These experimental results constitute new evidence for the charge independence of the nuclear forces. The excitation-absorption curve for the (γ, α) reaction in O^{16} with γ rays up to 31 Mev shows different peaks corresponding to excited levels in O^{16} at E^*: 16.75; 17.3; 22.6; 24.6 Mev with $J = 2^+$ and $T = 0$. (auth)

1117

MULTIPLE SCATTERING CORRECTION FOR COUNTER EXPERIMENTS. R. M. Sternheimer (Brookhaven National Lab., Upton N. Y.). Rev. Sci. Instr. 25, 1070-5(1954) Nov.

The fraction of the charged particles traversing an absorber in a counter experiment which miss the last counter because of multiple Coulomb scattering in the absorber has been calculated for a general counter geometry. The results are presented in the form of graphs which give the fraction of surviving particles as a function of the counter geometry and the amount of multiple scattering in the absorber. It is shown that the effect of a single scattering at large angles is very small. (auth)

RADIATION EFFECTS

1118

Knolls Atomic Power Lab.
AN EXPLORATORY INVESTIGATION OF GLASSES EX-POSED TO INTENSE NEUTRON RADIATIONS. H. G. Sowman and J. S. Lukesh. Nov. 15, 1954. 14p. Contract W-31-109-Eng-52. (KAPL-1242)

Seven glass specimens of binary and ternary compositions were observed after exposure to a total thermal integrated flux of approximately 2×10^{20} nvt. All of the glass specimens retained their vitreous character, original surface texture, and gloss after irradiation. No visible mechanical damage was evident in any of the samples. All were discolored to some extent, and significant density and hardness changes occurred in some. (auth)

1119

COLOR-CENTER MAGNETIC RESONANCE IN LiF. C. K. Jen and N. W. Lord (Johns Hopkins Univ., Silver Springs, Md.). Phys. Rev. 96, 1150-1(1954) Nov. 15.

The magnetic resonance in LiF single crystals bombarded by 50-kev x rays and 360-Mev protons was studied. (L.T.W.)

1120

THE CREEP OF ALUMINIUM DURING NEUTRON IRRADIATION. E. R. W. Jones, W. Munro, and N. H. Hancock (Atomic Energy Research Establishment, Harwell, Berks, England). J. Nuclear Energy 1, 76-86(1954) Aug.

A new method of measuring creep, suitable for use in a pile, has been developed, and one experiment on 99.8% aluminum has been done in the NRX pile at Chalk River, Canada. It has been shown that the creep rate is not significantly increased in a flux of 1.3×10^{12} fast and 6×10^{12} thermal neutrons. (auth)

RADIOACTIVITY

1121

Ames Lab.
RADIOACTIVE DISINTEGRATION SPECTRA OF SOME SHORT-LIVED NUCLIDES. Warren A. Hunt and D. J. Zaffarano. Mar. 1954. 48p. Contract W-7405-eng-82. (ISC-469)

The beta endpoint energies of several short-lived, low Z radioactive nuclides have been measured with an improved scintillation spectrometer. These values have been combined with recent half-life determinations to give the ft values. Data are presented on Mg^{23}, Si^{27}, S^{31}, Ca^{39}, Cl^{34}, K^{38}, and P^{39}. For the group of superallowed transitions, the ft values times $|\int 1|^2$ increase with mass. The ratio of gamma-ray intensity above 0.6 Mev to the intensity of the 0.51-Mev annihilation peak was less than two percent. A 15% resolution at 624 kev was obtained with the anthracene crystal and photomultiplier tube. The linearity of the scintillation pick-up and recording equipment was tested with the 1.70, 2.24, 4.45, and 13.4 Mev beta endpoints of P^{32}, Y^{90}, Cl^{34}, and Li^8, respectively. The targets, calibration system, and master control system which are used with the improved scintillation spectrometer are described. The control system automatically cycled the synchrotron, target, and recording system until a sufficient number of events to yield the desired statistical accuracy had been obtained. Seventy discrete channels of information were obtained with the multichannel analyzer. (auth)

1122

PRELIMINARY NOTE ON THE DISINTEGRATION OF TUNGSTEN[185]. Anka M. Mijatovic. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 4, 75-7(1954) June. (In English)

The spectrum of the electromagnetic radiation from W^{185} was measured by a scintillation spectrometer. The intensity of 134-kev gamma radiation in proportion to the β radiation was found to be about 5%. This contradicts the suggestion that β transition of W^{185} leads to the excited state of Re^{185} of 134-kev. (M.P.G.)

1123

GAMMA-RAY ENERGIES IN THE DECAY OF Cs^{134}. M. C. Joshi and B. V. Thosar (Tata Inst. of Fundamental Research, Bombay, India). Phys. Rev. 96, 1022-3(1954) Nov. 15.

The photoelectric conversion spectrum of gamma rays in the decay of Cs^{134} was studied with a newly installed Siegbahn-Slätis beta-ray spectrometer, using a strong source and thick lead and uranium radiators to bring out weak lines. Lines corresponding to the following gamma rays were found (expressed in kev): 467; 553; 571; 607; 794; 1027; 1164; 1368; 1401. (auth)

1124

BETA SPECTRUM OF C^{14}. H. H. Forster and A. Oswald (Univ. of Southern California, Los Angeles). Phys. Rev. 96, 1030-1(1954) Nov. 15.

The beta spectrum from thin sources of C^{14} was measured in a double thin-lens β-ray spectrometer; the momentum spectrum and the Fermi plot are presented. The Fermi plot for a source of approximately 15 $\mu g/cm^2$ is a straight line down to about 30 kev; the experiment therefore indicates an allowed shape for the beta spectrum of C^{14}. Existing experimental evidence to the contrary, that is, for a forbidden spectrum, is discussed and compared with the results of the present experiment. (auth)

1125

ALPHA-DECAY THEORY AND A SURFACE WELL POTENTIAL. George H. Winslow (Argonne National Lab., Lemont, Ill.). Phys. Rev. 96, 1032-44(1954) Nov. 15.

A discussion is given of the escape of an alpha particle from a square-well potential which is in the form of a spherical shell surrounding the daughter nucleus. In the present approximation the alpha particle, as such, is excluded from the interior of the nucleus by making the one-body potential infinite in that region. The usual Coulomb barrier is used. It is found that the properties of this model differ in several important respects from those of the usual square-well one-body model, in which the well is located at the origin of coordinates. Arguments are presented which lead to the representation of the many-body decay constant as the product of a dimensionless "preformation factor" and a one-body decay constant, as opposed to the usual product of an intrinsic nonbarrier decay constant and a dimensionless barrier transmission coefficient. The preformation factor involves an "intrinsic" alpha-decay probability and, in addition, the probability per sec that an alpha particle at the nucleus will be absorbed as nucleons. The nuclear physics problem of deriving expressions for these latter two probabilities is not considered, but examples are given which can be used to show expected ranges of numerical values of the preformation factor when the one-body model is either the present one or the usual one. (auth)

1126

THE γ-β-BRANCHING RATIO OF UX_2. THE HALF-LIFE OF UZ. W. L. Zijp, Sj. Tom, and G. J. Sizoo (Univ. of Amsterdam, Netherlands). Physica 20, 727-35(1954) Oct. (In English)

The γ-β branching ratio of UX_2 has been determined by comparison of the β activities of carrier-free UZ and UX_2 sources with a G-M counter. The yield of the UZ separation was measured with Pa^{233} as tracer. Special attention was given to the corrections for adsorption and backscattering. The branching ratio was found to be 0.63% with an estimated error of 10%. The half life of UZ was measured four times with very pure UZ sources. The final result was T = 6.658 ± 0.012h. (auth)

1127

STUDY OF THE RADIOACTIVITY OF Sb_{51}^{122}. Jean Moreau. Compt. rend. 239, 1130-2(1954) Nov. 3. (In French)

A determination of the energies and intensities of the partial β spectra of Sb^{122} was made with a magnetic spectrometer. A fourth spectral line was found by coincidence magnetic spectrometry. A disintegration scheme is proposed. (tr-auth)

1128

DETERMINATION OF RADIOELEMENTS BY THE DISTRIBUTION OF INTERVALS BETWEEN DISINTEGRATIONS. APPLICATION TO RdTh. D. Hirschberg (Universite Libre Bruxelles, France). Nuovo cimento (9) 12, 733-42(1954) Nov. (In French)

The pair of successive disintegrations $Ra^{220} \xrightarrow{\alpha} Po^{216} \xrightarrow{\alpha}$ is discussed. A proportional detector was used. A special circuit selected intervals smaller than a given time. The choice of optimum time is discussed. The smallest quantity of RdTh measurable by the method is that which is in equilibrium with about 3×10^{-9} g of Th. (tr-auth)

1129

COMPARISON OF FOUR NATIONAL RADIUM STANDARDS. PART 1. EXPERIMENTAL PROCEDURES AND RESULTS. T. I. Davenport, W. B. Mann, C. C. McCraven, and C. C. Smith. J. Research Natl. Bur. Standards 53, 267-72(1954) Nov.

The two United States primary radium standards have been compared with the British primary radium standards and the Canadian national radium standard (1) by an ionization method, using the NBS standard electroscope, (2) calorimetrically, using the Peltier-cooling radiation balance, (3) by means of a G-M counter, and (4) using a scintillation counter. Where there is little or no difference in gamma-ray source self-absorption, the four methods should, and in fact do, give good agreement. In the case of the Canadian national radium standard the difference in the results obtained is an indication of a difference in source self-absorption. (auth)

1130

COMPARISON OF FOUR NATIONAL RADIUM STANDARDS. PART 2. STATISTICAL PROCEDURES AND SURVEY. W. S. Connor and W. J. Youden. J. Research Natl. Bur. Standards 53, 273-5(1954) Nov.

The statistical analysis of the observations on the four national radium standards is discussed. The readings made with the electroscope, G-M counter, and scintillation counter were adjusted by one formula, and the readings made with the radiation balance by a different formula. In each case the adjusted values of the standards satisfy a consistency criterion. Finally, the adjusted values were improved by making use of the proportional relationship between the masses and the radioactive effects of the standards. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

1131

NEUTRON-DEFICIENT ACTIVITIES OF PRASEODYMIUM.

Thomas H. Handley and Elmer L. Olson (Oak Ridge National Lab., Tenn.). Phys. Rev. 96, 1003-5(1954) Nov. 15.

Neutron-deficient radionuclides of praseodymium were produced by proton bombardment of enriched isotopes of cerium and neodymium. Two unreported activities were found, 22-min Pr^{135} and 70-min Pr^{136}; the gamma and beta spectra of each were determined. Further study of 2.0-hr Pr^{138} and 4.5-hr Pr^{139} was also made, and gamma spectra of each are shown. The half life of Pr^{137} is shown to be <5 min or >1 year. Confirmation of assignment of 3.4-min Pr^{140} is made. (auth)

1132

NEUTRON RESONANCES IN THE RARE EARTH ELEMENTS. V. L. Sailor, H. H. Landon, and H. L. Foote, Jr. (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 96 1014-17(1954) Nov. 15.

The neutron cross sections of the fifteen rare earth elements (excepting Pm) have been measured in the energy range from 0.07 to ~ 20 ev with a crystal spectrometer. The resonances found are summarized in a table giving the resonant energies, E_0, and a qualitative value of the strength, $\sigma_0 \Gamma^2$. For some cases, the isotope responsible for the resonance has been identified and is also listed. (auth)

SPECTROSCOPY

1133

[California Inst. of Tech.]
FUNDAMENTAL RESEARCH IN SPECTROSCOPY OF SHORT WAVELENGTH X-RAYS AND GAMMA-RAYS. QUARTERLY PROGRESS REPORT FOR PERIOD JULY 1 TO SEPTEMBER 30, 1953. Jesse W. M. DuMond. 15p. Contracts N6onr-244, T. O. 4, Quarterly Report No. 26; AT(04-3)-8, Quarterly Report No. 4; and DA-04-495-Ord-444, Quarterly Report No. 2. (AECU-2963)

A 2-meter curved crystal γ-ray spectrometer was tested and used in determinations of the γ emission from Ta^{182}; the performance of a β spectrometer was tested and measurements were made of a Na^{22} source. Data are included on the spectra of Na^{22} and energy levels in Ne^{22}. A new and effective type of x-ray tube tested utilizes the radiation from a focused gas-discharge column and eliminates contamination of target surfaces in the production of long wavelength x radiation; an optical analogue method is described for the preparation of samples for examination under the electron microscope and a method for calibrating the electron microscope is described which consists of measuring the size of polystyrene latex spheres. (For preceding period see AECU-2767.) (C.H.)

1134

Duke Univ.
QUARTERLY PROGRESS REPORT OF DUKE MICROWAVE LABORATORY. REPORT NO. 7, AUGUST 1, 1954 — NOVEMBER 1, 1954. 70p. (NP-5429)

Progress is reported on studies of the Zeeman effect of nitric oxide; nuclear quadrupole coupling of Sb^{121}, Sb^{123}, and As^{75}; the millimeter-wave spectrum of stibine and arsine; the application of millimeter-wave techniques to the study of superconductivity at very high frequencies; and the possibility of using centimeter and millimeter-wave radiation from the sun to investigate the upper atmosphere. (C.H.)

1135

A CELL FOR THE MEASUREMENT OF INFRARED SPEC-

TRA IN LIQUID HYDROGEN FLUORIDE. Robert H. Maybury, Joseph J. Katz, and Sheffield Gordon (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. 25, 1133(1954) Nov.

The design and construction details of a cell to permit infrared spectro-photometric observations on liquid hydrogen fluoride are described. The cell has made it possible to obtain infrared spectra from 1 to 25μ for liquid hydrogen fluoride and liquid sulfur dioxide. (M.P.G.)

1136

THE DEUTERIUM-SULFIDE BAND AT 4,590 CM^{-1}. Harry C. Allen, Jr., Robert E. Naylor, and Earle K. Plyer. J. Research Natl. Bur. Standards 53, 321-3(1954) Nov.

The absorption of deuterium sulfide has been observed and measured under high resolution in the region from 4,513 cm^{-1} to 4,675 cm^{-1}. The rotational structure has been analyzed through the use of published energy and line-strength tables for the rigid asymmetric rotor. A classical centrifugal-distortion correction was applied to the rigid energy levels. The absorption is attributed to the vibrational band having an excited state with the quantum number $(n_1, n_2, n_3) = (1,1,1)$. The inertial parameters giving the best fit to the observed absorption are presented. Using the ground-state inertial constants, the D-S distance is calculated to be 1.345 A, and the D-S-D-angle 92° 16′, in excellent agreement with similar structural parameters determined for hydrogen sulfide from infrared studies. (auth)

1137

RAMAN SPECTRUM OF TRIFLUOROCHLOROETHYLENE. J. A. Rolfe and L. A. Woodward (Inorganic Chemistry Lab., Oxford, England). Trans. Faraday Soc. 50, 1030-5(1954) Oct.

The Raman spectrum of liquid trifluorochloroethylene, obtained at approximately −75°C using a Raman tube of 1 ml capacity, is found to show fourteen frequencies. Approximate degrees of depolarization of the lines are obtained by the method of polarized incident light. The results are discussed in relation to the different sets of fundamental vibration frequencies proposed by other workers. (auth)

1138

ISOTOPE SHIFT IN Hf I. J. A. Collinson (Yale Univ., New Haven, Conn.). Phys. Rev. 96, 949-50(1954) Nov. 15.

The hyperfine structure in Hf I lines has been resolved and found to consist of either a single line or a well resolved doublet. The components of the doublets are attributed to isotopes 178 and 180. The magnitudes of these shifts have been determined using several independent measurements. The typical size of the doublet separations is about 0.035 K. The arrangement of the shifts indicates that the configuration responsible for seven low-energy levels is $5d^2 6s^2$. The structure due to isotopes 176, 177, and 179 is nowhere well resolved. (auth)

THEORETICAL PHYSICS

1139

Laboratory for Nuclear Science, Mass. Inst. of Tech.
TABLES OF RADIAL SOLUTIONS OF THE DIRAC EQUATION FOR THE SCATTERING OF HIGH ENERGY ELECTRONS BY A POINT CHARGE. A. E. Glassgold and Evelyn W. Mack. Aug. 31, 1954. 44p. Contract N5ori-07806, Technical Report No. 65. (NP-5434)

1140

Rochester Univ.
BRIEF REPORT ON THE PRESENT STATUS OF MESON

THEORY OF NUCLEAR FORCES. M[aurice] M. Lévy
and R. E. Marshak. Nov. 3, 1954. 31p. Contract AT(30-1)-875. (NYO-6542)

1141

THE EFFECT OF NUCLEAR COMPRESSIBILITY ON THE
NUCLEAR PHOTOEFFECT. J. M. Araújo (Univ. of Manchester, England). Nuovo cimento (9) 12, 780-98(1954) Nov.
(In English)

A general two-fluid nuclear model is formulated for the
case in which the nuclear energy density depends only on
the local values of nucleon densities and not on their derivatives. Hydrodynamical equations, together with a generalized Laplace's equation, are derived taking account of compressibility. The energies corresponding to the lowest dipole
oscillation modes are calculated for a few nuclei and compared with Jensen-Steinwedel's and Danos' results for the
resonance energies for photon absorption. Better agreement
with the experimental data is obtained, especially, as might
be expected, for moderately heavy nuclei. (auth)

1142

OPTICAL MODEL OF NUCLEI AND ELASTIC BACK-SCATTERING OF π-MESONS. A. Minguzzi (Univ. of
Bologna, Italy). Nuovo cimento (9) 12, 799-806(1954) Nov.
(In English)

A general inequality is established connecting the differential elastic cross section at 90° and 180° in the limiting
case of a black nucleus. The optical model of nuclei is applied to the interaction of π mesons with the heavy elements
of Ilford G-5 plates. (auth)

1143

THE SELF MASS OF THE PHOTON. Asher Pressman.
Compt. rend. 239, 1023-5(1954) Oct. 27. (In French)

The solution of Maxwell's equations in curved space has
shown that the equation of motion of a group of electromagnetic waves is identical to that which is obtained for a
photon whose self mass is of the order of 10^{-65} g. It is
shown here that certain considerations connected with the
solution of these equations give a result which is independent
of the postulates of wave mechanics. (K.S.)

1144

PSEUDOSCALAR MESON THEORY. Bernard Jouvet.
Compt. rend. 239, 1121-3(1954) Nov. 3. (In French)

It is shown that the single postulate of the existence of
Fermi pseudoscalar coupling between nucleons and leptons
necessarily implies the existence of pseudoscalar mesons
whose characteristics (masses and coupling constants) can
be calculated from the properties of single fermion fields.
(tr-auth)

URANIUM AND URANIUM COMPOUNDS

1145

ENERGY DEPENDENCE OF THE U^{235} FISSION CROSS
SECTION IN THE LOW ENERGY REGION. Dragoslav
Popović (Joint Establishment for Nuclear Energy Research,
Kjeller, Norway). J. Nuclear Energy 1, 3-4(1954) Aug.

The variation of the cross section for fission of U^{235} with
energy was measured in the energy region 0.01 to 0.14 ev
by comparing the counting rates of a fission counter and a
boron counter. It was found that the fission cross section
falls off with energy more rapidly than that of boron. The
explanation may be the existence of an energy level below
the binding energy of the neutron in U^{235}. (M.P.G.)

1146

THE NEUTRON ABSORPTION CROSS SECTIONS OF U^{238}
AND U^{235} AT 2,200 M/SEC. P. A. Egelstaff (Atomic Energy
Research Establishment, Harwell, Berks, England). J. Nuclear Energy 1, 92(1954) Aug.

The neutron absorption cross sections of U have been
determined by transmission measurements using a conventional thermal neutron time-of-flight spectrometer. The
absorption cross section of U^{235} is 720 ± 15 barns and that of
U^{238} is 2.8 ± 0.1 barns. (M.P.G.)

1147

THE GOLD-URANIUM SYSTEM. R. W. Buzzard and J. J.
Park. J. Research Natl. Bur. Standards 53, 291-6(1954)
Nov.

The phase diagram of the gold—uranium system was
constructed from data obtained by thermal analysis, metallographic examination, and x-ray diffraction. The system is
characterized by two intermetallic compounds, one forming
peritectically at 1,216°C and having an apparent composition
of U_2Au_3, and the other melting congruently at approximately
1,450°C and having an apparent composition of UAu_3. There
are two eutectics, one between UAu_3 and gold at 855°C and
87.5 atomic percent of gold, and the other between uranium
and U_2Au_3 at 1,105°C and 10.5 atomic percent of gold. The
solubility of uranium in gold appeared to be about 0.6 atomic
percent at 855°C, and the solubility of gold in uranium was
approximately 3.2 atomic percent at 1,105°C. Gold lowered
the gamma-beta transformation temperature of uranium
from 762° to 738°C, and the beta-alpha transformation from
653° to 647°C. (auth)

1148

RADIOCHEMICAL MEASUREMENTS OF THE NATURAL
FISSION RATE OF URANIUM. P. K. Kuroda and R. R.
Edwards (Univ. of Arkansas, Fayetteville). J. Chem. Phys.
22, 1940(1954) Nov.

Forty-five milligrams of Sr (as the carbonate) without
added carrier was isolated from 2.5 kg of pitchblende
(41.70% U_3O_8) for use in obtaining the current total (spontaneous plus neutron-induced) fission rate in a common U
mineral. The sample was decontaminated from Ra and Ba
activities. Results of the radioactivity measurements are
given. Assuming a fission yield of 5% for Sr^{90}, the data indicated $(1.3 ± 0.1) \times 10^{-14}$c Sr^{90}/g U^{238}, corresponding to an
over-all fission half life of $(5.9 ± 0.6) \times 10^{15}$ yr. A value of
$(6.1 ± 1.5) \times 10^{15}$ yr was obtained from the Sr^{89}/U^{238} ratio,
assuming a fission yield of 4.5% for Sr^{90}. The Sr^{89}/Sr^{90}
activity ratio is reported to be near unity. (J.A.G.)

1149

CHOICE OF SUPPORTING ELECTROLYTES FOR THE
POLAROGRAPHIC DETERMINATION OF URANIUM IN THE
PRESENCE OF IRON AND COPPER. Milenko V. Susic.
Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 4, 57-8
(1954) June. (In English)

Supporting electrolytes have been examined for the polarographic determination of U in low concentrations either
alone or in the presence of Fe and Cu. A table of results
is given. (M.P.G.)

1150

POLAROGRAPHIC DETERMINATION OF URANIUM.
Milenko V. Susic. Bull. Inst. Nuclear Sci. "Boris Kidrich"
(Belgrade) 4, 59-62(1954) June. (In English)

It has been shown that uranium can be polarographed

without difficulty from solutions containing many other ions by using specific supporting electrolytes. In some cases a few elements interfere, but two easy methods are given for their removal. (auth)

1151

COLORIMETRIC DETERMINATION OF URANIUM WITH AMMONIUM THIOCYANATE. Vladan S. Jovanović and Eva F. Zucker. Bull Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 4, 111-18(1954) June. (In English)

The colorimetric NH_4SCN method for the determination of submilligram amounts of U in the presence of Fe is shown to be satisfactory. Determination can be carried out in an acid solution (H_2SO_4 or HCl) without pH control. (M.P.G.)